



NOAA SCIENTIFIC PUBLICATIONS REPORT FEBRUARY 10, 2014

HIGHLIGHTED ARTICLES

[Breeding sex ratios in adult leatherback turtles \(*Dermochelys coriacea*\) may compensate for female-biased hatchling sex ratios](#)

[Historical commercial exploitation and the recent recovery of Hawaiian green turtles](#)

[Analysis of energy flow in U.S. GLOBEC ecosystems using end-to-end models](#)

[Distribution patterns of Pacific halibut in relation to environmental variables along the continental shelf waters of the U.S. West Coast and southern British Columbia](#)

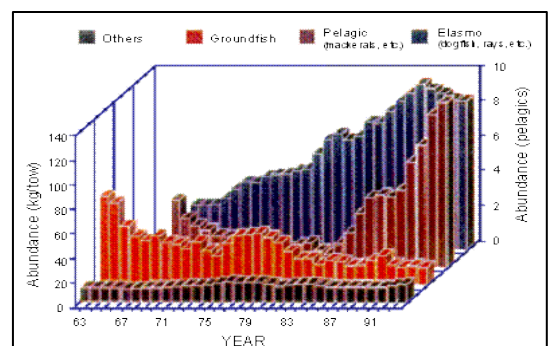
[Back to the future: The history of acroporid corals at the Flower Garden Banks, Gulf of Mexico, USA](#)

[Ontogenetic niche expansion influences mercury exposure in the Antarctic silverfish \(*Pleuragramma antarcticum*\)](#)

[Exploring impacts of development and climate change on stormwater runoff](#)

[Lacaziosis-like disease among bottlenose dolphins *Tursiops truncatus* photographed in Golfo Dulce, Costa Rica](#)

[Clinicoimmunopathologic findings in Atlantic bottlenose dolphins *Tursiops truncatus* with positive Chlamydiaceae antibody titers](#)





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ADDITIONAL ARTICLES

[Improved historical temperature and precipitation time series for U.S. climate divisions](#)

[Large-scale atmospheric and oceanic conditions during the 2011–12 DYNAMO field campaign](#)

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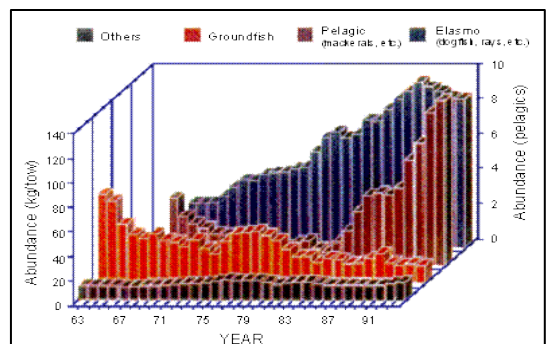
[Abundance, distribution, and population growth of the northern elephant seal \(*Mirounga angustirostris*\) in the United States from 1991 to 2010](#)

[Quantitative video analysis of flatfish herding behavior and impact on effective area swept of a survey trawl](#)

[Descriptions of eggs of snailfishes \(family Liparidae\) from the Bering Sea and eastern North Pacific Ocean](#)

[Limited gene flow in *Uca minax* \(LeConte 1855\) along a linear estuary](#)

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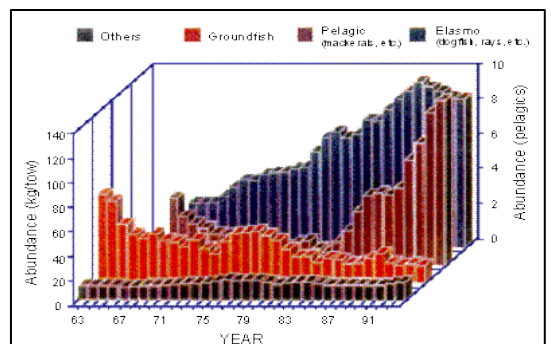
[Histological changes in traumatized skeletal muscle exposed to seawater: a canine cadaver study](#)

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[Modeling PCB-bioaccumulation in the bottlenose dolphin \(*Tursiops truncatus*\): estimating a dietary threshold concentration](#)

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[Toxicological effects of the sunscreen UV filter, benzophenone-2, on planula and *in vitro* cells of the coral, *Stylophora pistillata*](#)

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[Endangered Species Act listing; three case studies of data deficiencies and consequences of ESA 'threatened' listing on research output](#)

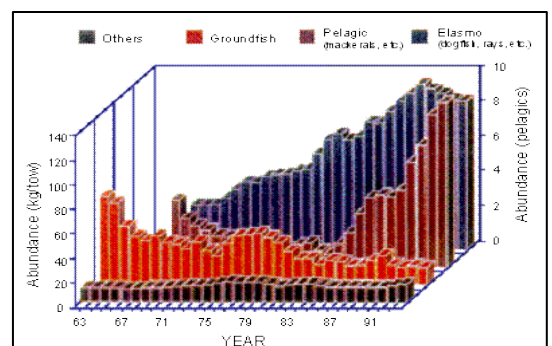
[A mixing model to include uncertainty in sediment fingerprinting](#)

[Combining demographic and genetic factors to assess population vulnerability in stream species](#)

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OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

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HIGHLIGHTED ARTICLES

*Breeding sex ratios in adult leatherback turtles (*Dermochelys coriacea*) may compensate for female-biased hatchling sex ratios*

PLOS ONE

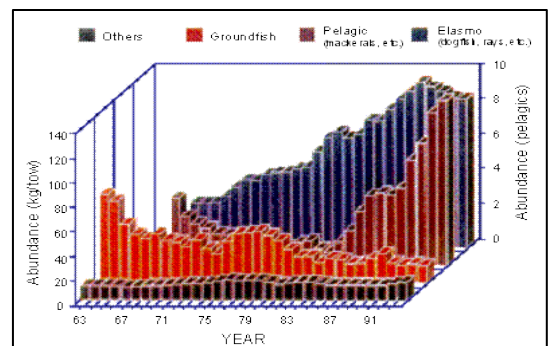
K. R. Stewart and P. H. Dutton (NMFS/SWFSC)

- There have been concerns that climate change may feminize populations that exhibit temperature-dependent sex determination, and in particular sea turtle populations. Hatchling sea turtle sex ratios tend to be female-biased.
- The authors evaluated the number of successfully breeding males and females for the leatherback population at St. Croix (USVI) using genotypes of females and their hatchlings to identify fathers and reconstruct male genetic fingerprints.
- The authors found that males are not lacking in the population, with 47 males for 46 females successfully breeding in 2010. They caution that breeding sex ratios should be monitored, but that worries about feminizing populations may be premature.

For vertebrates with temperature-dependent sex determination, primary (or hatchling) sex ratios are often skewed, an issue of particular relevance to concerns over effects of climate change on populations. However, the ratio of breeding males to females, or the operational sex ratio (OSR), is important to understand because it has consequences for population demographics and determines the capacity of a species to persist. The OSR also affects mating behaviors and mate choice, depending on the more abundant sex. For sea turtles, hatchling and juvenile sex ratios are generally female-biased, and with warming nesting beach temperatures, there is concern that populations may become feminized. The authors' purpose was to evaluate the breeding sex ratio for leatherback turtles at a nesting beach in St. Croix, USVI. In 2010, they sampled nesting females and later sampled their hatchlings as they emerged from nests. Total genomic DNA was extracted and all individuals were genotyped using 6 polymorphic microsatellite markers. Authors genotyped 662 hatchlings from 58 females, matching 55 females conclusively to their nests. Of the 55, 42 females mated with one male each, 9 mated with 2 males each and 4 mated with at least 3 males each, for a multiple paternity rate of 23.6%. Using GERUD1.0, we reconstructed parental genotypes, identifying 47 different males and 46 females for an estimated breeding sex ratio of 1.02 males for every female. Thus they demonstrated that there are as many actively breeding males as females in this population. Concerns about female-biased adult sex ratios may be premature, and mate choice or competition may play more of a role in sea turtle reproduction than previously thought. We recommend monitoring breeding sex ratios in the future to allow the integration of this demographic parameter in population models.

Published: February 4, 2013

<http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0088138;jsessionid=23AB1D240DFBBFB48917D673C32C81A>





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Historical commercial exploitation and the recent recovery of Hawaiian green turtles

Biological Conservation

K. Van Houtan (NMFS/PIFSC) and J. N. Kittinger

- Understanding the precise mechanisms for historical population decline is important for contemporary management for both single species and ecosystem-based management.
- Overharvest caused severe declines in the Hawaiian green turtle population. However the population has increased since their listing under the Endangered Species Act in 1978. Authors analyzed three decades (1948-1974) of commercial landings from a green turtle fishery in the Hawaiian Islands.
- The authors use this example to discuss how historical studies can inform conservation management, and how socioeconomic factors can help interpret historical population declines and manage today's threats.

Biodiversity conservation is often limited by short-term records of abundance, geographic distribution, and population dynamics. Historical information can provide a context for assessing current population status and defining recovery, especially for populations recovering from chronic human overexploitation. Here authors analyze three decades (1948-1974) of commercial landings from a green turtle fishery in the Hawaiian Islands. Artisanal and commercial overharvesting drove the population to its listing under the U.S. Endangered Species Act in 1978, but the population has since increased and its recovery is being debated. While this turtle fishery was small in scale with a limited effort, productivity, and revenue we find dramatic declines in catch-per-unit-effort and a spatial progression that strongly suggest rapid local population depletion. Harvests initially targeted coastal areas near commercial markets but quickly shifted to exploit more remote areas, expanded effort, and increasingly relied on more extractive gears. Additional analyses of economic data, restaurant menus, and expert interviews indicate the fishery was driven by limited, local demand. The seemingly incommensurate scale of the fishery and its impacts indicate the Hawaiian green turtle population was already significantly depleted when commercial fishery began. Authors describe how historical studies can inform conservation management, including population assessments.

Published: February 2014

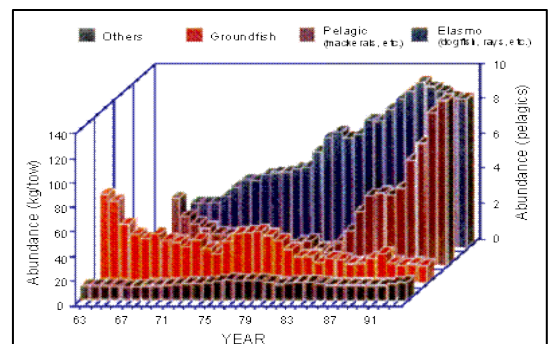
<http://www.sciencedirect.com/science/article/pii/S000632071300390X>

Analysis of energy flow in U.S. GLOBEC ecosystems using end-to-end models

Oceanography

J. J. Ruzicka, J. H. Steele, **S. K. Gaichas (NMFS/NEFSC)**, T. Ballerini, D. J. Gifford, **R. D. Brodeur (NMFS/NWFSC)**, E. E. Hoffman

- Multi-species, end-to-end ecosystem models are useful tools for understanding the processes that drive ecosystem variability.





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- They are also tools for assessing the health of an ecosystem as an ecological unit and are necessary for testing the impacts of alternative management policies across entire marine communities.
- With the combined efforts of integrated data collection programs like GLOBEC and comparative modeling activities such as those presented here, more detailed models of specific processes may be developed to improve understanding of ecosystem structure, mechanics, and response to environmental variability and anthropogenic perturbation.

End-to-end models were constructed to examine and compare the trophic structure and energy flow in coastal shelf ecosystems of four US Global Ocean Ecosystem Dynamics (GLOBEC) study regions: the Northern California Current, the Central Gulf of Alaska, Georges Bank, and the Southwestern Antarctic Peninsula. High-quality data collected on system components and processes over the life of the program were used as input to the models. Although the US GLOBEC program was species-centric, focused on the study of a selected set of target species of ecological or economic importance, we took a broader community-level approach to describe end-to-end energy flow, from nutrient input to fishery production. We built four end-to-end models that were structured similarly in terms of functional group composition and time scale. The models were used to identify the mid-trophic level groups that place the greatest demand on lower trophic level production while providing the greatest support to higher trophic level production. In general, euphausiids and planktivorous forage fishes were the critical energy-transfer nodes; however, some differences between ecosystems are apparent. For example, squid provide an important alternative energy pathway to forage fish, moderating the effects of changes to forage fish abundance in scenario analyses in the Central Gulf of Alaska. In the Northern California Current, large scyphozoan jellyfish are important consumers of plankton production, but can divert energy from the rest of the food web when abundant.

Accepted: December 2013

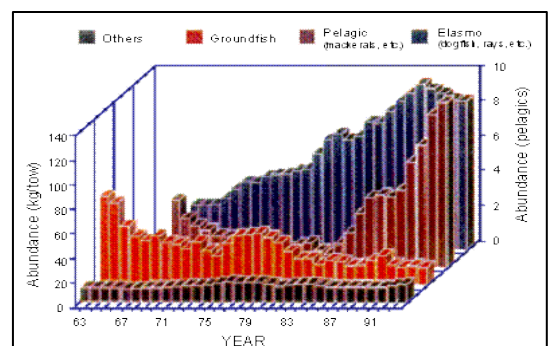
Distribution patterns of Pacific halibut in relation to environmental variables along the continental shelf waters of the U.S. West Coast and southern British Columbia

Fisheries Oceanography

L. Sadorus, **N. Mantua (NMFS/SWFSC)**, T. Essington, B. Hickey, and S. Hare

- Long-line survey data indicate that halibut may avoid locations with dissolved oxygen (DO) concentrations less than 0.9 ml/L.
- Because west coast long-line surveys take place in seasons and locations known to be susceptible to shelf hypoxia, space-time variations in DO may cause variations in catch per unit effort unrelated to stock abundance.

Knowing how Pacific halibut (*Hippoglossus stenolepis*) distribute in relation to ocean conditions is of primary importance to halibut managers, as they are tasked with estimating stock size and designing effective monitoring programs amidst a changing climate. This research examined near-bottom





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environmental data alongside halibut survey catch data for the years 2006-2009 on the continental shelf of Oregon, Washington, and southern British Columbia. The objectives of the research were: 1) characterize summer environmental conditions and halibut distribution; 2) explore ranges and possible tolerance thresholds for halibut in relation to temperature, dissolved oxygen (DO), salinity, and pH, and; 3) identify the primary environmental factors affecting distribution of halibut and model the observed relationships. Seasonal hypoxia is an annual feature of the study area and results suggest halibut exhibited an apparent DO minimum threshold of 0.9 ml/L. Ordinary least squares multiple regression analysis indicated that depth, temperature, and DO were significant variables in predicting halibut distribution, whereas salinity and bottom type were not. Ambiguity in model results led to the use of two additional analytical methods, geographically weighted regression (GWR) and tree regression, to examine regional variation and the overarching structure of halibut distribution. The three models yielded similar results indicating the importance of DO and temperature as variables describing structure. The GWR model yielded the best fit of the three when using DO as a predictor variable, indicating that regional variation is a factor. These results suggest that low, but above threshold, DO may be contributing to catchability differences in the survey.

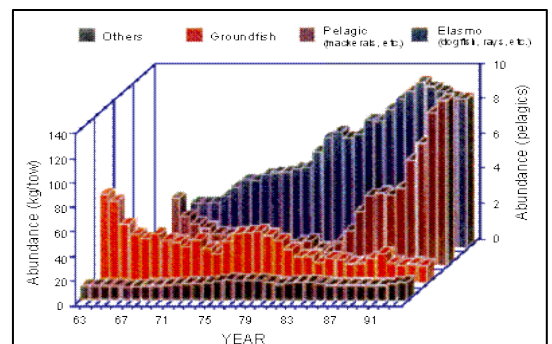
Expected Publication Date: Spring 2014

Back to the future: the history of acroporid corals at the Flower Garden Banks, Gulf of Mexico, USA
Marine Geology

W. F. Precht, K. J. P. Deslarzes, **E. L. Hickerson**, **G. P. Schmahl**, **M. F. Nuttall**, and R. B. Aronson
(NOS/ONMS)

- Authors report the discovery of fossil elkhorn corals at the Flower Garden Banks (FGB) on the shelf-margin off the Texas coast in 2006.
- Prior to this discovery, the existence of this fossil elkhorn coral reef was unknown at Flower Gardens Bank. The overlying massive boulder corals that dominate the coral caps were thought to be the history of the coral reefs in the Sanctuary.
- This discovery writes a new chapter in the history of the region. The recent return of elkhorn corals, listed under the Endangered Species Act as threatened to reefs in the Sanctuary are thought to be associated with increasing sea temperatures and appears to be both an echo of the past and a harbinger of the future.

This paper presents the discovery of fossil elkhorn corals, *Acropora palmata*, at the Flower Garden Banks (FGB) on the shelf-margin off the Texas coast in 2006. Radiocarbon dating revealed an *A. palmata*-dominated community aged 10,157–6838 cal BP. The *Acropora* reefs correspond in time to an interval of warmer-than-present sea-surface temperatures (SSTs) during the Holocene thermal maximum (HTM). The subsequent demise of *A. palmata* in the middle Holocene was a consequence of the inability of the shallowest reef facies to keep pace with rising sea level following complete submergence of the banks,





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possibly coupled with decreasing SSTs following the HTM. In 2007, the first fossil staghorn corals, *Acropora cervicornis*, were discovered at the FGB. Based on radiocarbon dating of these corals to 1027-211 cal BP, it appears that populations of *A. cervicornis* flourished in deeper waters (~25-32 m depth) on the edges of the banks until the peak of the Little Ice Age when they died, presumably from cold-water exposure. The recent return of *A. palmata* to reefs of the FGB associated with increasing sea temperatures appears to be both an echo of the past and a harbinger of the future.

Published Online: January 2, 2014

<http://www.sciencedirect.com/science/article/pii/S0025322713002673>

Ontogenetic niche expansion influences mercury exposure in the Antarctic silverfish (Pleuragramma antarcticum)

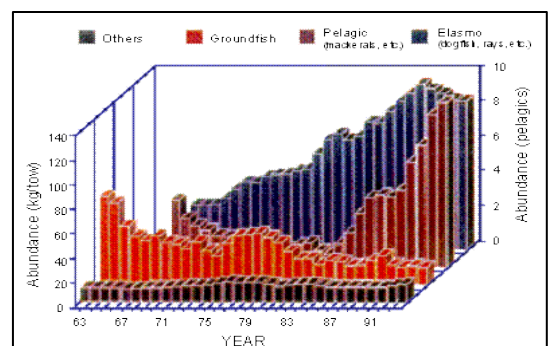
Marine Ecology Progress Series

R.L. Brasso, J. Langa, **C.D. Jones (NMFS/SWFSC)**, and M.J. Polito

- Mercury concentrations in this ecologically important Antarctic prey fish were characterized
- Demonstrated that mercury concentrations in *P. antarcticum* varied with body size or age class
- There is an apparent relationship between mercury accumulation and ontogenetic variation in diet and foraging habitat in this species

The effects of body size and age-class on mercury concentrations were examined in the Antarctic silverfish (*Pleuragramma antarcticum*), an ecologically important prey species in the Antarctic marine food web. Stable isotope analysis was used to investigate variation in mercury concentrations related to ontogenetic changes in diet and/or foraging habitat. Specimens of *P. antarcticum* were collected along the Ross Sea shelf in February 2008 and mercury concentrations in homogenized whole fish and muscle tissue were analyzed relative to standard length, age class (juvenile vs. adult) and isotopic measures of diet ($\delta^{15}\text{N}$) and foraging habitat ($\delta^{13}\text{C}$). While mercury concentration in muscle tended to be higher than whole fish values, concentrations in these two matrices were highly correlated. A positive relationship was found between standard length and mercury concentration; further, adult *P. antarcticum* had significantly higher mercury concentrations than juveniles. Adult mercury concentrations were also more variable in which the coefficient of variation in adult muscle (58.3%) was more than twice that found in juveniles (25.0%). Though no linear relationships were detected between standard length and $\delta^{15}\text{N}$ or $\delta^{13}\text{C}$ values when all individuals were combined, juvenile and adult size-classes of fish differed in their isotopic niche position and width. In addition, $\delta^{13}\text{C}$ values explained the greatest amount of variation in whole fish mercury across all age classes and for adult fish alone. By expanding both the horizontal and vertical components of their foraging habitat, adult *P. antarcticum* may have a wider range of exposure to mercury compared to juvenile fish.

Expected Publication Date: April 2014





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Exploring impacts of development and climate change on stormwater runoff

Hydrological Processes

A. Blair, S. Lovelace, and D. Sanger (NOS/NCCOS/Center for Human Health Risk (CHHR))

- By evaluating a range of potential land development and climate change scenarios, managers and others can work at resolving stormwater runoff issues during the planning process before the impacts associated with them become irreversible.
- For example, a community planner can model runoff amounts in proposed developments and then superimpose climate change impacts on the development impacts in order to evaluate potential impairment to local waters.
- The Stormwater Runoff Modeling System (SWARM) can serve as a community science education tool for general audiences by showing connectivity between rainfall, runoff, and risk of ecological harm and societal impacts such as flooding.

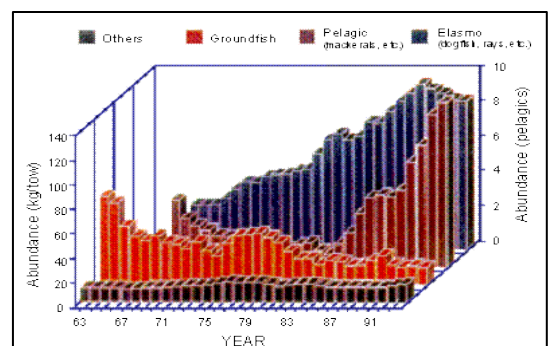
Stormwater runoff is a leading cause of non-point source pollution in urbanizing areas, and runoff effects will be exacerbated by climate's changing patterns of precipitation. To enhance understanding of impacts of development and climate change on stormwater runoff in small watersheds (< 6500 ha), we developed the Stormwater Runoff Modeling System (SWARM), a simple modeling system based on U.S. Department of Agriculture, Natural Resources Conservation Service curve number and unit hydrograph methods. The objective of this paper is to describe the applications possible with SWARM and to demonstrate its usefulness in exploring the impacts of development and climate change on runoff. Results encompass a range of impact scenarios. One development scenario shows that the amount of rainfall converted to runoff is 27% for an undeveloped area and 67% for a highly developed area. A climate scenario shows that the amount of rainfall converted to runoff in a medium developed area is 25% in drought conditions and 76% in wet conditions. User-friendly templates make SWARM a good tool for scientific research, for resource management and decision making, and for community science education. The modeling system also supports the investigation of social and economic impacts to communities as they adapt to increased development and climate change. Although we calibrated SWARM specifically to the southeast coastal plain, it can be applied to other regions by recalibrating parameters and modifying calculation templates. Published Online: May 7, 2013

<http://onlinelibrary.wiley.com/doi/10.1002/hyp.9840/abstract>

Lacaziosis-like disease among bottlenose dolphins Tursiops truncatus photographed in Golfo Dulce, Costa Rica

Diseases of Aquatic Organisms

B.L. Bessesen, L. Oviedo, L. B. Hart, D. Herra-Miranda, J. D. Pacheco-Polanco, L. Baker, G. Saborio, L. Bermudez, and A. Acevedo-Gutierrez (NOS/NCCOS/Center for Human Health Risk (CHHR))





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- This study documents the potential endemicity of a zoonotic pathogen among bottlenose dolphins in Costa Rican waters and provides epidemiological information regarding the extent, discrepancies in susceptibility, and possible environmental factors contributing to the occurrence of the disease.

Lacaziosis (a.k.a. lobomycosis) is a chronic dermal disease caused by the fungal agent *Lacazia loboi*, which affects both humans and dolphins. Photographic data have been used to identify lacaziosis-like disease (LLD) among dolphins in the waters of North and South America and we now report LLD in bottlenose dolphins off the coast of Costa Rica, the first reporting in Central American waters. During the periods of 1991-1992 and 2010-2011, three research teams conducted separate dolphin surveys in the Pacific tropical fiord, Golfo Dulce, and each LLD in Costa Rica documented skin lesions in the resident population of bottlenose dolphins, *Tursiops truncatus*. Photo-ID records were used to identify LLD-affected bottlenose dolphins and to assess their lesions. Findings showed between 13.2% and 16.1% of the identified dolphins exhibited lesions grossly resembling lacaziosis. By combining efforts and cross-referencing photographic data, the teams explored the presence of LLD in Golfo Dulce over a time gap of approximately 20 years. Findings expand the geographical range of the disease and offer insight into its longevity within a given population of dolphins.

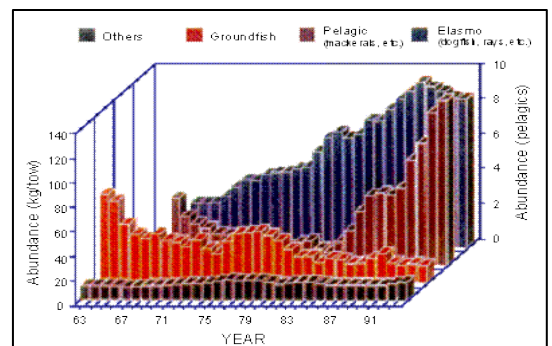
Accepted: October 29, 2013

*Clinicoimmunopathologic findings in Atlantic bottlenose dolphins *Tursiops truncatus* with positive *Chlamydiaceae* antibody titers*

Diseases of Aquatic Organisms

G. D. Bossart, T. A. Romano, M. M. Peden-Adams, A. Schaefer, S. McCulloch, J. D. Goldstein, C. D. Rice, **P. A. Fair**, C. Cray, and J. S. Reif (**NOS/NCCOS/Center for Coastal Environmental Health and Biomolecular Research (CCEHBR)**)

- While clinical disease due to *Chlamydiaceae* infection has not been reported in the IRL and CHS dolphins, the present report suggests that *Chlamydiaceae* infection impacts health subclinically.
- Potential subclinical health impacts are important for the IRL and CHS dolphin populations as past studies indicate that both dolphin populations are impacted by other complex infectious and neoplastic diseases often associated with immunologic perturbations and anthropogenic contaminants.
- The intricate dynamic interactions between various infectious agents and environmental factors highlight the complexity of evaluating health in dolphins. Additionally, these interactions may further complicate our understanding of disease pathogenesis and the detection of the contributing factors in population morbidity and mortality events since the effect of any single factor may be obscured or confounded by other contributors.





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Sera from free-ranging Atlantic bottlenose dolphins (*Tursiops truncatus*) inhabiting the Indian River Lagoon (IRL), Florida and coastal waters of Charleston (CHS), South Carolina were tested for antibodies to Chlamydiaceae as part of a multidisciplinary study of individual and population health. A suite of clinicoimmunopathologic variables was evaluated in Chlamydiaceae seropositive dolphins (n=43) and seronegative healthy dolphins (n=83). Fibrinogen, LDH, amylase and absolute numbers of neutrophils, lymphocytes and basophils were significantly higher and serum bicarbonate, total alpha globulin and alpha-2 globulin were significantly lower in dolphins with positive Chlamydiaceae titers compared with seronegative healthy dolphins. Several differences in markers of innate and adaptive immunity also were found. Con A induced T lymphocyte proliferation, LPS induced B lymphocyte proliferation and granulocytic phagocytosis were significantly lower and absolute numbers of CD 21 mature B lymphocytes, NK activity and lysozyme concentration were significantly higher in dolphins with positive Chlamydiaceae antibody titers compared to seronegative healthy dolphins. Additionally, dolphins with positive Chlamydiaceae antibody titers had significant increases in ELISA antibody titers to *Erysipelothrix rhusiopathiae*. These data suggest that Chlamydiaceae infection may produce subclinical clinicoimmunopathologic perturbations that impact health. Any potential subclinical health impacts are important for the IRL and CHS dolphin populations as past studies indicate that both dolphin populations are affected by other complex infectious and neoplastic diseases often associated with immunologic perturbations and anthropogenic contaminants.

Accepted: December 4, 2013

ADDITIONAL ARTICLES

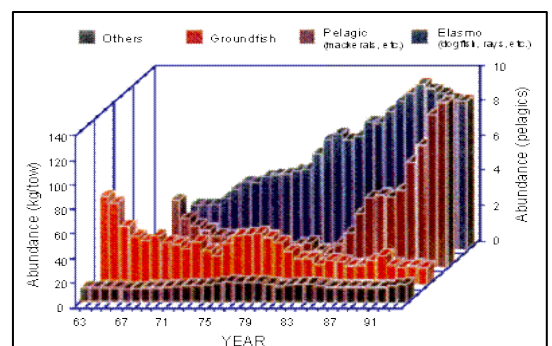
Improved historical temperature and precipitation time series for U.S. climate divisions

Journal of Applied Meteorology and Climatology

R. S. Vose, S. Applequist, M. Squires, I. Durre, M. J. Menne, C. N. Williams Jr., C. Fenimore, K. Gleason and D. Arndt (NESDIS/NCDC)

- This paper describes an improved edition of the climate division dataset for the conterminous United States (i.e., version 2).
- The three-pronged enhancements implemented in version 2 yield a more representative climate record than version 1.
- Investment in expanding the network of observing sites and application of advanced data analysis techniques has paid off in a more accurate climate division dataset.

The first improvement is to the input data, which now includes additional station networks, quality assurance reviews, and temperature bias adjustments. The second improvement is to the suite of climatic elements, which now includes both maximum and minimum temperature. The third improvement is to the computational approach, which now employs climatologically aided interpolation to address topographic and network variability. Version 2 exhibits substantial differences with version 1 over the





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period 1895–2012. For example, divisional averages in version 2 tend to be cooler and wetter, particularly in mountainous areas of the western United States. Division-level trends in temperature and precipitation display greater spatial consistency in version 2. National-scale temperature trends in version 2 are comparable to those in the U.S. Historical Climatology Network whereas version 1 exhibits less warming as a result of historical changes in observing practice. Divisional errors in version 2 are likely less than 0.5 °C for temperature and 20 mm for precipitation at the start of the record, falling rapidly thereafter. Overall, these results indicate that version 2 can supersede version 1 in both operational climate monitoring and applied climatic research.

Accepted: 10 January 2014

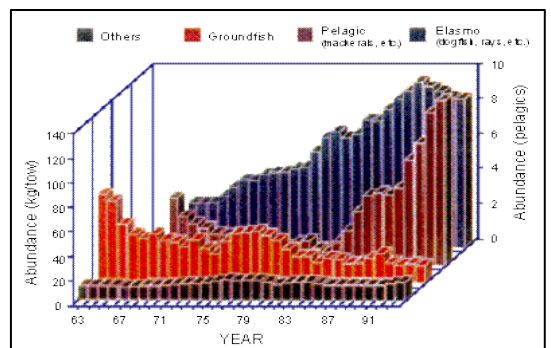
Large-scale atmospheric and oceanic conditions during the 2011–12 DYNAMO field campaign

Monthly Weather Review

J. Gottschalck (NWS/CPC), P. E. Roundy , C. J. Schreck III (NESDIS/NCDC), A. Vintzileos (NWS/CPC), and C. Zhang

- The DYNAMO campaign benefited from an unusually active period of MJO activity. The December 2011 event had characteristics of both an MJO and a Kelvin wave. Research using the campaign's observations of this hybrid system may improve our ability to categorize and predict future events
- This paper summarizes conditions during the Dynamics of the MJO (DYNAMO) field international field campaign, which was sponsored in part by NOAA. Since it provides background on weather events during the campaign, it will probably be cited by numerous studies that use the DYNAMO data, including those funded by NOAA.

An international field campaign, Dynamics of the Madden Julian Oscillation (DYNAMO), took place in the Indian Ocean during October 2011 – March 2012 to collect observations for the Madden-Julian oscillation (MJO), especially its convective initiation processes. The large-scale atmospheric and oceanic conditions during the campaign are documented here. The ENSO and the Indian Ocean dipole (IOD) states, the monthly mean monsoon circulation and its associated precipitation, humidity, vertical and meridional/zonal overturning cells, and ocean surface currents are discussed. The evolution of MJO events is described using various fields and indices that have been used to subdivide the campaign into three periods. Period 1: 17 September – 8 December .2011 featured two robust MJO events that circumnavigated the global tropics with a period of less than 45 days; Period 2: 9 December, 2011 – 31 January, 2012, contained less coherent activity and Period 3: 1 February – 12 April 2012, featured the strongest and most slowly propagating MJO event of the campaign. Activities of convectively coupled atmospheric Kelvin and equatorial Rossby (ER) waves and their interaction with the MJO are discussed. The overview of the atmospheric and oceanic variability during the field campaign raises several scientific issues pertaining to our understanding of the MJO, or lack thereof. Among others, roles of Kelvin and ER waves in MJO convective initiation, convection-circulation decoupling on the MJO scale,





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applications of MJO filtering methods and indices, and ocean–atmosphere coupling need further research attention.

Expected Publication Date: December 2013

Surface charge controls the fate of Au nanorods in saline estuaries

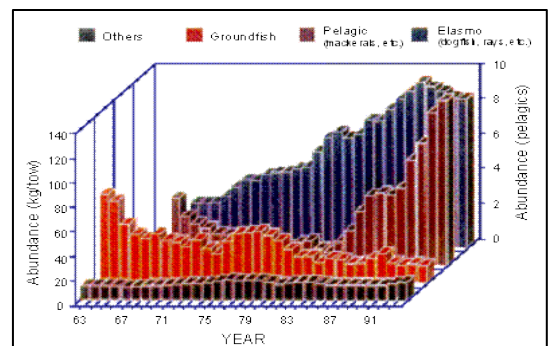
Environmental Science & Technology

J. M. Burns, **P. L. Pennington**, P. Sisco, R. Frey, S. Kashiwada, **M. H. Fulton**, **G. Scott**, A. W. Decho, C. J. Murphy, T. J. Shaw, J. L. Ferry (**NOS/NCCOS**)

- This finding suggests possible entry mechanisms of nanomaterials into estuarine foodwebs. It suggests that positively charged particles enter via feeding mechanisms associated with organic floc while negatively charged particles enter via feeding associated with sediment.
- In the current study, sediments were the most important phase for removing negatively charged nanoparticles from the water column (accounting for 78% of the recovered gold), whereas in a previous study with positively charged particles, the sediments only accounted for approximately 20% of the total nanoparticles.
- This above ratio is nearly reversed for biofilms. At the end of the exposure, approximately 20% of recovered negatively charged nanoparticles partitioned into the biofilms as opposed to 80% of the positively charged nanoparticles.

This work reports the distribution of negatively charged, gold core nanoparticles in a model marine estuary as a function of time. A single dose of purified polystyrene sulfonate (PSS) coated gold nanorods was added to a series of three replicate estuarine mesocosms to emulate an abrupt nanoparticle release event to a tidal creek of a *Spartina*-dominated estuary. The mesocosms contained several phases that were monitored: seawater, natural sediments, mature cordgrass, juvenile northern quahog clam, mud snails and grass shrimp. Aqueous nanorod concentrations rose rapidly upon initial dosing then fell to stable levels over the course of approximately 50 hr, after which they remained stable for the remainder of the experiment (41 days total). The concentration of nanorods rose in all other phases during the initial phase of the experiment, however some organisms demonstrated depuration over extended periods of time (100 hr +), even in the dosed tanks. Clams and biofilm samples were also removed from the contaminated tanks post exposure to monitor their depuration in pristine seawater. The highest net uptake of gold (mass normalized) occurred in the biofilm phase during the first 24 hrs, after which it was stable (to the 95% level of confidence) throughout the remainder of the exposure experiment. The results are compared against a previous study of positively charged nanoparticles of the same size to parameterize the role of surface charge in determining nanoparticle fate in complex aquatic environments.

Accepted: 21 October 2013





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In silico prediction and in vivo validation of Daphnia pulex microRNAs

PLoS ONE

S. Chen, G. McKinney, **K. M. Nichols (NMFS/NWFSC)**, M. Sepulveda

- *Daphnia pulex*, the crustacean with the first sequenced genome, is an important organism that has been widely used in ecological and toxicological research.
- This is the first study to identify and validate miRNAs in *Daphnia pulex*, which is an important first step in further studies that evaluate their roles in development and response to environmental and ecological stimuli.

MicroRNAs (miRNAs) are 21–25 nucleotide small non-coding RNAs that are involved in a myriad of physiological processes. In this research, the authors predicted 75 *D. pulex* miRNAs by sequence homology and secondary structure identification from the full genome sequence. Fourteen predicted miRNAs were selected for quantitative real time polymerase chain reaction (RT-PCR) validation. Out of these, eight (mir-8, mir-9, mir-12, mir-92, mir-100, mir-133, mir-153 and mir-283) were successfully amplified and validated. Next, expression levels were quantified at three different life stages (days 4, 8 and 12 of age) using U6 spliceosomal RNA as a reference gene. The expression of mir-8, mir-9, mir-12, mir-92 and mir-100 significantly differed across time suggesting these microRNAs might play a critical role during *D. pulex* development.

Published: 6 January 2014

<http://dx.plos.org/10.1371/journal.pone.0083708>

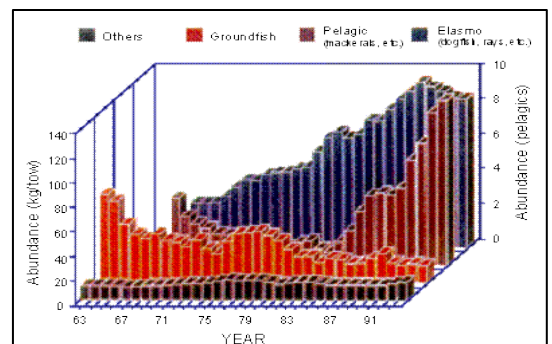
Blue whale vocalizations recorded around New Zealand: 1964 - 2013

Journal of the Acoustical Society of America

B. Miller, K. Collins, **J. Barlow**, S. Calderan, R. Leaper, M. McDonald, P. Ensor, **P. Olson**, C. Olavarria, and M. Double (NMFS/SWFSC)

- Sounds that had been recorded around New Zealand since the mid-1960s have been definitively shown to be made by blue whales.
- These New Zealand blue whales are now known to be found all around both the North and South Islands of New Zealand.
- These blue whale sounds have changed slowly over the past 50 years.

Previous underwater recordings made in New Zealand have identified a complex sequence of low frequency sounds that have been attributed to blue whales based on similarity to blue whale songs in other areas. Recordings of sounds with these characteristics were made opportunistically during the Southern Ocean Research Partnership's recent Antarctic Blue Whale Voyage. These sounds were detected all around the South Island of New Zealand during the voyage transits from Nelson, New Zealand to the Antarctic and return. By following acoustic bearings from directional sonobuoys, blue whales were visually detected and confirmed as the source of these sounds. These recordings, together with the





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historical recordings made northeast of New Zealand indicate song types that persist over several decades, and are indicative of the year-round presence of a population of blue whales that inhabits the waters around New Zealand. Measurements of the four-part vocalizations reveal that blue whale song in this region has changed slowly, but consistently over the past 50 years. The most intense units of these calls were detected as far south as 53°S, which represents a considerable range extension compared to the limited prior data on the spatial distribution of this population.

Expected Publication Date: 10 April 2014

Evidence for multiple navigational sensory capabilities by Chinook salmon

Aquatic Biology

B. J. Burke (NMFS/NWFSC), J. J. Anderson, A. M. Baptista

- In this study the researchers created a model to explain the complex distribution and migration of Chinook salmon.
- Salmon exhibit knowledge of their location in the marine environment, suggesting sensory capabilities such as having a map and compass sense.

To study the complex coastal migrations patterns exhibited by juvenile Columbia River Chinook salmon as they enter and move through the marine environment, the researchers created an individual-based model in a coupled Eulerian-Lagrangian framework. Five distinct migration strategies were modeled and compared the resulting spatial distributions to catch data collected during May and June in 3 years. Two strategies produced fish distributions similar to those observed in May, but only one also produced the observed June distributions. In both strategies, salmon distinguish north from south (i.e. they have a compass sense), and they control their position relative to particular landmarks, such as the river mouth. With these 2 abilities, the researchers posit that salmon follow spatially explicit behavior rules that prevent entrapment in strong southward currents and advection offshore. Additionally, the consistent spatio-temporal distributions observed among years suggest that salmon use a clock sense to adjust their swim speed, within and among years, in response to progress along their migration.

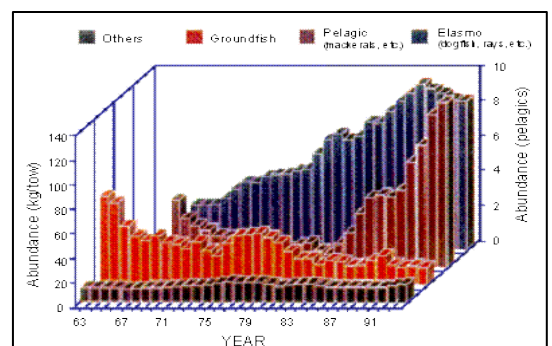
Expected Publication Date: Spring 2014

Predicting connectivity of green turtles at Palmyra Atoll, Central Pacific: a focus on mtDNA and dispersal modeling

Journal of the Royal Society Interface

E. Naro-Maciel, S. J. Gaughran, N. F. Putman, G. Amato, F. Arengo, **P. H. Dutton, (NMFS/SWFSC)**, K. W. McFadden, E. C. Vintinner, and E. J. Sterling.

- Here the authors combined powerful genetic analysis with high quality simulations of particle dispersal in an ocean circulation model to investigate the distribution of green turtles foraging at the remote Palmyra Atoll National Wildlife Refuge, Central Pacific.





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- Comparing findings from genetics and modeling highlighted the complex impacts of ocean currents and behavior on natal origins.
- This study provides valuable information to improve knowledge of stock boundaries for green turtles in the Pacific, particularly relevant to ESA mandates, including population assessment and ongoing NMFS-USFWS Status Review and Recovery Planning.

Population connectivity and spatial distribution are fundamentally related to ecology, evolution, and behavior. Mitochondrial sequences were analyzed from turtles ($n = 349$) collected there over five years (2008 - 2012). Genetic analysis assigned natal origins almost exclusively ($\sim 97\%$) to the West Central and South Central Pacific combined Regional Management Units. Further, the modeling results indicated that turtles could potentially drift to Palmyra Atoll via surface currents along a near-Equatorial swathe traversing the Pacific. Comparing findings from genetics and modeling highlighted the complex impacts of ocean currents and behavior on natal origins. Although the Palmyra feeding ground was highly differentiated genetically from others in the Indo-Pacific, there was no significant differentiation among years, sexes, or stage-classes at the Refuge. Understanding the population distribution of this foraging population advances knowledge of green turtles and contributes to effective conservation planning for this threatened species.

Expected Publication Date: March 2014

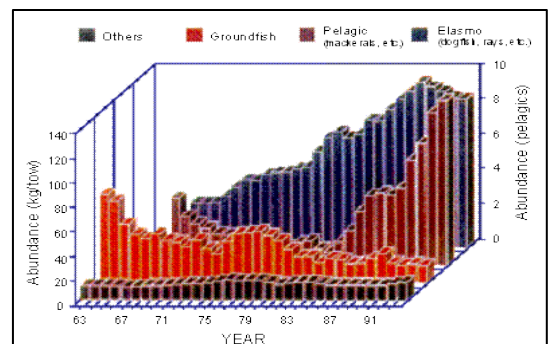
Characterizing and predicting essential habitat features for juvenile coastal sharks

Marine Ecology

C. A. Ward-Paige, G. L. Britten, D. M. Bethea, J. K. Carlson (NMFS/SEFSC)

- Multiple shark species concurrently use nursery habitat and different environmental factors drive species occurrence.
- Essential habitat designations for sharks need to consider a host of environmental conditions.

The successful management of shark populations requires juvenile recruitment success. Thus, conservation initiatives now strive to include the protection of areas used by pre-adult sharks in order to promote juvenile survivorship. Many shark species use inshore areas for early life stages; however, species often segregate within sites to reduce competition. Using a fisheries-independent gillnet survey from the northern Gulf of Mexico (2000-2010) we describe distribution patterns and preferred habitat features of the juveniles of six shark species. Our results suggest that multiple shark species concurrently use the area for early life stages and although they overlap they exhibit distinct habitat preferences characterized by physical variables. Habitat suitability models suggest that temperature, depth, and salinity are the important factors driving juvenile shark occurrence. Within each site, across the sampled range of physical characteristics, blacktip shark (*Carcharhinus limbatus*) preferred higher temperature ($>30^\circ\text{C}$) and mid-depth ($\sim 5.5\text{ m}$); bonnethead shark (*Sphyrna tiburo*) preferred higher temperature ($>30^\circ\text{C}$) and mid-salinity (30-35 PSU), finetooth shark (*C. isodon*) preferred low salinity ($<20\text{ PSU}$) with mid-





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depth (~4 m), scalloped hammerhead shark (*S. lewini*) preferred high temperature (>30 °C) and salinity (>35 PSU), Atlantic sharpnose shark (*Rhizoprionodon terraenovae*) preferred high temperature (>30 °C) and deep water (>6 m), and spinner shark (*C. brevipinna*) preferred deep water (>8 m) and high temperature (>30 °C). The other investigated factors, including year, month, latitude, longitude, bottom type, inlet distance, coastline and human coast were not influential for any species. Combining habitat preferences with the sampled environmental characteristics, we predicted habitat suitability throughout the four sites for which physical characteristics were sampled. Habitat suitability surfaces highlight the differences in habitat use between and within sites. This work provides important insight into the habitat ecology of juvenile shark populations, which can be used to better manage these species and protect critical habitat.

Accepted: 13 January 2014

Survey of antibiotic resistant bacteria isolated from bottlenose dolphins (Tursiops truncatus) in the Southeastern US

Diseases of Aquatic Organisms

J. R. Stewart, F. I. Townsend, S. M. Lane, E. Dyar, **A. A. Hohn (NMFS/SEFSC)**, **T. K. Rowles (NMFS/OPR)**, L. A. Staggs, R. S. Wells, B. C. Balmer, **L. H. Schwacke (NOS/NCCOS)**

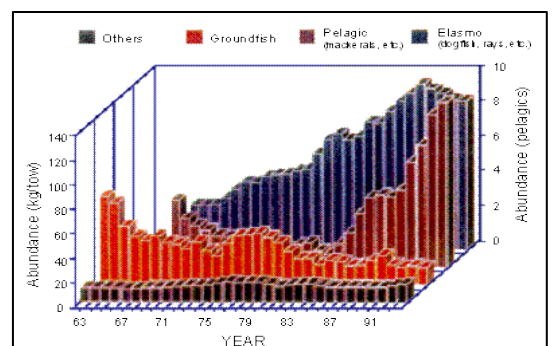
- This is the first comparative survey of bacteria and bacterial resistance in free-ranging *Tursiops* from the southeast US

This study isolated bacterial species of relevance to humans from wild bottlenose dolphins (*Tursiops truncatus*), and assayed isolated bacteria for antibiotic resistance. Samples were collected during capture-release dolphin health assessments at multiple coastal and estuarine sites along the mid-Atlantic United States and the Gulf of Mexico. These samples were transported on ice and evaluated using commercial systems and aerobic culture techniques routinely employed in clinical laboratories. The most common bacteria identified were species belonging to the genus *Vibrio*, although *Escherichia coli*, *Shewanella putrefaciens* and *Pseudomonas fluorescens/putida* were also common. Some of the bacterial species identified have been associated with human illness, including a strain of methicillin-resistant *Staphylococcus aureus* (MRSA) identified once. Widespread antibiotic resistance was observed among all sites, although the percentage of resistant isolates varied across sites and across time. These data provide a baseline for future comparisons of the bacteria that colonize bottlenose dolphins in the Southeastern US.

Accepted: 4 December 2013

Parasites as biological tags of marine, freshwater, and anadromous fishes in North America from the tropics to the Arctic

Parasitology





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D. J. Marcogliese, K. C. Jacobson (NMFS/NWFSC)

- This is an invited review for publication in a special issue of Parasitology on parasites as biological tags.
- Parasites can successfully be employed to increase understanding of fish stock separation and migration.

Parasites have been considered as natural biological tags of marine fish populations in North America for almost 75 years. In the Northwest Atlantic, the most studied species include Atlantic cod (*Gadus morhua*), Atlantic herring (*Clupea harengus*) and the redfishes (*Sebastes* spp.). In the North Pacific, research has centered primarily on salmonids (*Oncorhynchus* spp.). However, parasites have been applied as tags for numerous other pelagic and demersal species on both the Atlantic and Pacific coasts. Relatively few studies have been undertaken in the Arctic, and these were designed to discriminate anadromous and resident salmonids (*Salvelinus* spp.). Although rarely applied in fresh waters, parasites have been used to delineate certain fish stocks within the Great Lakes-St. Lawrence River basin. Anisakid nematodes and the copepod *Sphyrion lumpi* frequently prove useful indicators in the Northwest Atlantic, while myxozoans parasites prove very effective on the coast and open seas of the Pacific Ocean. Relative differences in the ability of parasites to discriminate between fish stocks on the Pacific and Atlantic coasts may be due to oceanographic and bathymetric differences between regions. Molecular techniques used to differentiate populations and species of parasites show promise in future applications in the field.

Expected Publication Date: Spring 2014

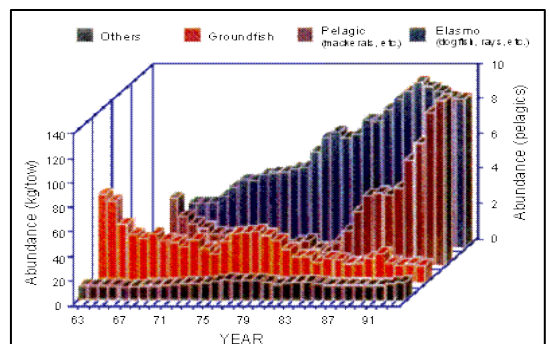
*Abundance, distribution, and population growth of the northern elephant seal (*Mirounga angustirostris*) in the United States from 1991 to 2010*

Aquatic Mammals

M. S. Lowry (MMTD, SWFSC), R. Condit, B. Hatfield, S. G. Allen, R. Berger, P. A. Morris, B. J. Le Boeuf, and J. Reiter

- This study reports on the distribution and abundance of the northern elephant seal (*Mirounga angustirostris*) in the United States from 1991 to 2010.
- Population of northern elephant seals in the U. S. growing at average annual rate of 3.8%.
- In 2010, the population of northern elephant seals in U. S. was estimated to be 179,000 individuals.

Pup production (i.e., births) was the principal metric used to characterize abundance, distribution, and population growth of the U.S. population and of each rookery in the U.S. Birth estimates were obtained from the literature and estimated from recent counts of adult females or counts of pups made during ground and aerial photographic surveys conducted during the pupping-breeding season at all rookeries in central California and the Channel Islands in southern California. A total of 40,684 pups were estimated to have been born at 11 rookeries in the U.S. in 2010. The two most productive rookeries in





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2010 were San Miguel Island (16,208 pups) and San Nicolas Island (10,882 pups). The Piedras Blancas rookery was not established in 1991 but has since grown to be the fourth largest rookery in 2010. Rookeries grew most rapidly initially, presumably due to high immigration rates, then increased moderately and eventually became stable, and some declined in size. Since 1988 the U.S. population has been growing at an average annual rate of 3.8%. The multiplicative factor needed to estimate total population size from pup production is estimated at 4.4. Total U.S. population size in 2010 is estimated at 179,000 individuals. Using conservative estimates for population growth of northern elephant seals in Mexico, we estimate that the total population in Mexico and the U.S. in 2010 was between 211,000 and 234,000 individuals.

Expected Publication Date: February 2014

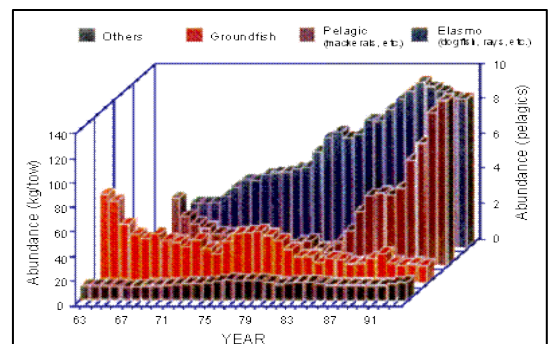
Quantitative video analysis of flatfish herding behavior and impact on effective area swept of a survey trawl
Fisheries Research

D. R. Bryan, K. L. Bosley, A. C. Hicks M. A. Haltuch, and W. W. Wakefield (NMFS/NWFSC)

- In this study fish behavioral response to bottom trawl sweeps was quantified using video.
- Herding of flatfishes by mud gear (or sweeps) is occurring at some distance in front of the net wings on the trawl used for the NWFSC West Coast Bottom Trawl Survey making the effective area swept by the NWFSC survey bottom trawl greater than the wing spread of the trawl
- Using wing spread to calculate relative abundance estimates explains bias in flatfish stock assessment estimates of survey catchability that are greater than expected

Uncertainty in fish behavior can introduce bias into density calculations from fishery-independent bottom trawl surveys that provide relative abundance estimates and population trends for stock assessments. *In situ* video was used to quantify flatfish behavioral responses to a bottom trawl sweep to improve the understanding of survey and assessment results. The behavior of 632 flatfishes was recorded during four tows. More than 90% of fish were observed in a perpendicular orientation away from the sweeps indicating a herding response. There was no significant effect of fish length on fish orientation or whether it reacted or remained stationary during the observation. Only 1.3% of fish were observed escaping the sweeps. A generalized linear model was used to estimate that at a distance of 73.8 cm (± 3.4 SE) 50% of observed fish reacted to the sweep. The mean distance that stationary fish were first observed reacting to the sweep was 36.6 cm (± 2.0 SE). Quantitative analysis indicates that flatfish herding occurs along trawl sweeps and the effective area swept is greater than the wing spread. Thus, the use of wing spread to calculate relative abundance estimates explains bias in stock assessment estimates of survey catchability that are greater than expected.

Expected Publication Date: Spring 2014





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Descriptions of eggs of snailfishes (family Liparidae) from the Bering Sea and eastern North Pacific Ocean Ichthyological Research

A. A. Overdick, M. S. Busby, and D. M. Blood (NMFS/AKFSC)

- Liparids are an important trophic component in marine ecosystems, both as predators of small benthic invertebrates and nekton, including age-0 flatfish, as well as prey for higher trophic level organisms.
- The ability to accurately identify eggs and larvae of liparids will expand our knowledge of these species and enable us to better understand the community structures and ecology of the Alaskan and eastern North Pacific Ocean marine ecosystems

Eggs of liparid fishes were collected by bottom trawl in the southeastern Bering Sea and removed from an oceanographic mooring cable off the coast of British Columbia, Canada. Eggs were large with embryos most commonly in late flexion to postflexion stages. Based on meristic counts and collection localities, eggs were identified as *Elassodiscus tremebundus*, *Paraliparis rosaceus*, and *Careproctus* sp. (either *Careproctus colletti* or *Careproctus melanurus*). Eggs of *E. tremebundus* are oval with a smooth, opaque chorion. Eggs of *P. rosaceus* are spherical and the chorion is sculptured with a uniformly pebbled texture. Eggs of *Careproctus* sp. are slightly oval and the chorion is smooth and opaque. Embryos of all species are unpigmented. A pelvic disk is present in embryos of *E. tremebundus*, but it is rudimentary: a small patch of tissue that was visible only after embryos were cleared and stained. Adults of the genus *Paraliparis* do not have a pelvic disk and no disk was observed in developing embryos. Embryos of *Careproctus* sp. have a large disk with rays visible in later stages. Hatching glands are present on the head and nape of embryos of all three species. Hatching glands of *E. tremebundus* are separated into bands across the snout, along the jaws and opercle, and in a patch on the nape, while those of *P. rosaceus* and *Careproctus* sp. are evenly distributed over the head and nape. This is the first full description of the embryonic stages of these taxa.

Published: January 2014

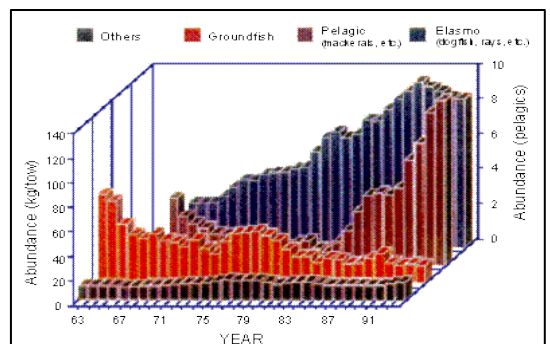
<http://link.springer.com/article/10.1007/s10228-013-0384-5>

*Limited gene flow in *Uca minax* (LeConte 1855) along a linear estuary* Central European Journal of Biology

J. L. Staton, S. A. Borgianini, I. B. Gibson, T. W. Greig (NOS/NCCOS)

- Observed data fit with model predictions in that fiddler crab larval transport within a tidally influenced river system is limited.
- Data imply that gene flow is limited and that unique evolutionary units may be present in a much greater frequency than previously thought. Possibility of cryptic species exists.

For crab larvae, swimming behaviors coupled with the movement of tides suggests that larvae can normally move upstream within estuaries by avoiding ebb tides and actively swimming during flood





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stages. Recently, a 1-D transport model incorporating larval behavior predicted that opposing forces of river discharge and tidal amplitude in the Pee Dee River/Winyah Bay system of South Carolina, USA, could limit dispersal within a single estuary for downstream transport as well as become a dispersal barrier to recruitment of late stage larvae to the freshwater adult habitats of *Uca minax*. We sequenced 394-bp of the mitochondrial cytochrome apoenzyme b for 226 adult *Uca minax*, from four locales along a 49-km stretch of the Pee Dee/Winyah Bay estuary above and below the boundary of salt intrusion. Results of an analysis of molecular variance (AMOVA) and an exact test of population differentiation showed a small, but statistically significant ($\alpha=0.05$) population subdivision among adults of the 4 subpopulations and well as subpopulation being significantly differentiated ($\alpha=0.05$). This pattern fitted with model predictions, which implies that larval transport within the tidally influenced river system is limited.

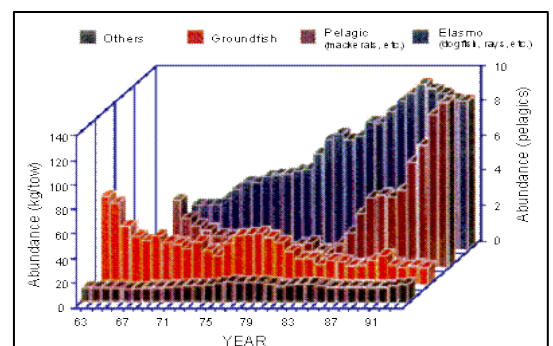
Accepted: 2 May 2013

Assessment of radiometric dating for age validation of deep-water dogfish (Order: Squaliformes) finspines PLoS ONE

C. F. Cotton, **A. H. Andrews (NMFS/PIFSC)**, G. M. Cailliet, R. D. Grubbs, S. B. Irvine, J. A. Cusick

- In this study the authors sought to age two deep-water dogfish species by analyzing ^{210}Pb and ^{226}Ra incorporated into the internal dentine of the finspines.
- Age validation should be central to any age determination study, yet to date no age and growth study of deep-water sharks has included a complete validation of age estimate.
- Although radiometric age determination for shark dorsal finspines using the ^{210}Pb and ^{226}Ra disequilibrium method proved unsuccessful in various test samples, new developments in radiometric techniques may prove useful for future studies of these taxa.

Vertebrae of most deep-water sharks are too poorly calcified to record visible growth bands and, therefore, are not useful for age determination. These radiometric age estimates were compared with counts of internal growth bands observed in the finspines. A pilot study indicated the dorsal finspines of *Centroselachus crepidater* are too small and thus offer insufficient mass for the radiometric techniques employed in this study. For ageing larger finspines of *Centrophorus squamosus*, the lead-radium disequilibrium method (ingrowth of ^{210}Pb from ^{226}Ra) was found to be inapplicable due to exogenous uptake of ^{210}Pb in the finspine. Therefore, to approximate age, we measured the decay of ^{210}Pb within the dentine material at the tip of the finspine (formed *in utero*), relative to the terminal material at the base of the finspine. Results with this method proved to be inconsistent and did not yield reliable age estimates. Hence the use of ^{210}Pb and ^{226}Ra for radiometric age determination and validation using dorsal finspines from these deep-water dogfishes was deemed unsuccessful. This outcome was likely due to violations of the consistent, life-long isotopic uptake assumption as well as the provision that the finspine must function as a closed system for these radioisotopes. Future improvements in analytical precision





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will allow for smaller samples to be analyzed, potentially yielding a better understanding of the fate of these radioisotopes within fin spine dentine throughout the life of the shark.

Expected Publication Date: February 2014

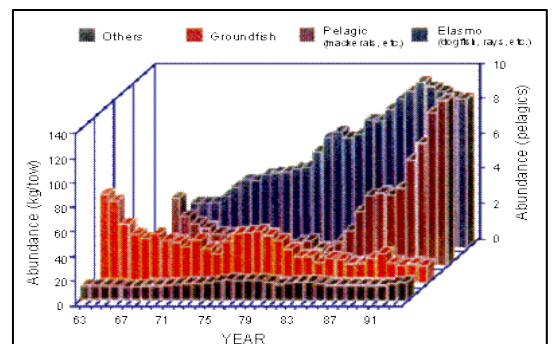
Seasonal carbonate chemistry covariation with temperature, oxygen and salinity in a fjord estuary: implications for the design of ocean acidification experiments

PLoS ONE

J. C. P. Reum (NMFS/NWFSC), P. McElhany (NMFS/NWFSC), R. Feely (OAR/PMEL), and S. Alan (OAR/PMEL)

- Absence of information on coastal carbonate chemistry variability and patterns of covariation with other biologically important variables hampers studies designed to address the impacts changes in ocean acidification.
- Authors analyzed a large carbonate chemistry dataset from winter, summer and fall in Puget Sound, a large fjord estuary on the U.S. west coast and found potential high-frequency changes in carbonate chemistry, temperature, and oxygen conditions experienced simultaneously by organisms.
- Results provide a basis for identifying control conditions in ocean acidification experiments in Puget Sound, and highlight the wide range of carbonate chemistry conditions organisms may currently experience in similar coastal systems.

Carbonate chemistry variability is often poorly characterized in coastal regions and the patterns of covariation with other biologically important variables such as temperature, oxygen, and salinity are rarely evaluated. This absence of information hampers the design and interpretation of ocean acidification experiments that aim to characterize biological responses to future pCO₂ levels relative to contemporary conditions. The authors analyzed a large carbonate chemistry data set from Puget Sound, a large fjord estuary on the U.S. west coast, and included measurements from three seasons (winter, summer, and fall). pCO₂ exceeded 2008–2011 mean atmospheric levels (389 μ atm) at all depths and seasons sampled except for the near-surface waters (< 10 m) in the summer. Further, undersaturated conditions with respect to the biogenic carbonate mineral aragonite were widespread ($\Omega_{ar} < 1$). The authors show that pCO₂ values were relatively uniform throughout the water column and across regions in the winter, enriched in stratified, deep waters in the summer, and in the fall some values exceeded 2500 μ atm in near-surface waters. Carbonate chemistry covaried to differing levels with temperature and oxygen depending primarily on season and secondarily on region. Salinity, which varied little (27 to 31), was weakly associated with carbonate chemistry. The authors illustrate potential high-frequency changes in carbonate chemistry, temperature, and oxygen conditions experienced simultaneously by organisms in Puget Sound that undergo diel vertical migrations under current day conditions and used simple calculations to estimate future pCO₂ and Ω_{ar} values experienced by diel vertical migrators based on





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potential increase in atmospheric CO₂. Given the potential for non-linear interactions between pCO₂ and other abiotic variables on physiological and ecological processes, their results provide a basis for identifying control conditions in ocean acidification experiments for this region, but also highlight the wide range of carbonate chemistry conditions organisms may currently experience in this and similar coastal systems.

Expected Publication Date: Winter 2014

Modeling dynamic interactions and coherence between marine copepods and fishes linked to environmental variability

Journal of Marine Systems

H. Liu, **M. J. Fogarty, J. A. Hare**, C. H. Hsieh, S. M. Glaser, and D. Sugihara (NMFS/NEFSC)

- The paper uses relatively new methods in nonlinear time series analysis to demonstrate inter-relationships among zooplankton, planktivorous fish, and the environment.

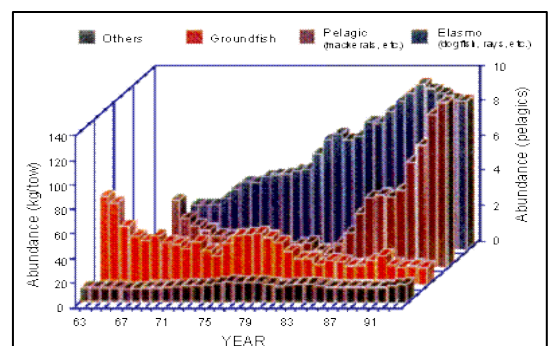
The dynamics of marine fish populations are closely related to lower trophic levels and the environment. Quantitatively understanding the underlying dynamic interactions among environmental variability, prey resources, and exploited fishes is critical for moving toward ecosystem-based management of marine living resources. However, most standard models typically grounded in the concept of linear system may fail to capture the underlying complexity of ecological processes. We have attempted to extend the limit by modeling the dynamics interactions of ecosystem components in a framework of nonlinear time series models. We modeled annual time series of 4 environmental indices, 22 marine copepod taxa, and 4 ecologically important fish species during 1977 to 2009 on Georges Bank, a highly productive and intensively studied area of the northeast U.S. continental shelf ecosystem. We examined the underlying dynamic features of environmental indices and marine copepods, and the dynamic interactions and coherence with fishes using nonlinear time series models. We found: (1) the system dynamics of marine copepods and environmental variables exhibit clear evidence of nonlinearity; (2) little evidence of complex dynamics across taxonomic levels of marine copepods; and (3) strong dynamic interactions and coherence between fishes and copepods. These findings highlight the nonlinear behavior of ecosystem components and importance of marine zooplankton on fish populations which point to a bottom-up process likely regulating the dynamics of fish populations in the Georges Bank ecosystem under a changing environment.

Accepted: 12 December 2013

Decadal changes in zooplankton of the Northeast U.S. continental shelf

PLoS ONE

H. Bi, R. Ji, H. Liu, J. Young-Heon, and **J. Hare** (NMFS/NEFSC)





NOAA SCIENTIFIC PUBLICATIONS REPORT

FEBRUARY 10, 2014

- Authors monitored the abundance of two species of copepod on the northeast US continental shelf from 1977-2010.
- Observed long term changes in the northern region were different from the southern region for both species, highlighting the importance of spatial scales in the study of marine populations.
- Authors suggest that to better understand copepod dynamics, information on advection, local hydrographic conditions, food quality and availability, predator and population processes including fecundity, growth and mortality is necessary.

The abundance of the subarctic copepod, *Calanus finmarchicus*, and temperate, shelf copepod, *Centropages typicus*, was estimated from samples collected bi-monthly in over the Northeast U.S. continental shelf (NEUS) from 1977 – 2010. Latitudinal variation in long term trends and seasonal patterns for the two copepod species were examined for four sub-regions: the Gulf of Maine (GOM), Georges Bank (GB), Southern New England (SNE), and Mid-Atlantic Bight (MAB). Results suggested that there was significant difference in long term variation between northern region (GOM and GB), and the MAB for both species. *C. finmarchicus* generally peaked in May – June throughout the entire study region and *Cen. typicus* had a more complex seasonal pattern. Time series analysis revealed that the peak time for *Cen. typicus* switched from November – December to January - March after 1985 in the MAB. The long term abundance of *C. finmarchicus* showed more fluctuation in the MAB than the GOM and GB, whereas the long term abundance of *Cen. typicus* was more variable in the GB than other sub-regions. Alongshore transport was significantly correlated with the abundance of *C. finmarchicus*, i.e., more water from north, higher abundance for *C. finmarchicus*. The abundance of *Cen. typicus* showed positive relationship with the Gulf Stream north wall index (GSNWI) in the GOM and GB, but the GSNWI only explained 12 – 15% of variation in *Cen. typicus* abundance. In general, the alongshore current was negatively correlated with the GSNWI, suggesting that *Cen. typicus* is more abundant when advection from the north is less. However, the relationship between *Cen. typicus* and alongshore transport was not significant. The present study highlights the importance of spatial scales in the study of marine populations: observed long term changes in the northern region were different from the south for both species. To better understand copepod dynamics, information on advection, local hydrographic conditions, food quality and availability, predator and population processes including fecundity, growth and mortality is necessary.

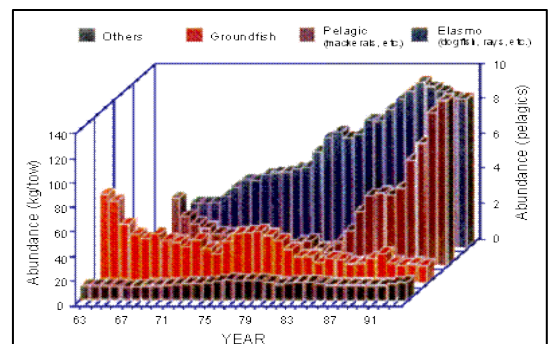
Accepted: 10 January 2014

A modified multivariate Madden-Julian oscillation index using velocity potential

Monthly Weather Review

M. J. Ventrice, M. C. Wheeler, H. H. Hendon, **C. J. Schreck III** (NESDIS/NCDC), C. D. Thorncroft, **G. N. Kiladis** (OAR/ESRL)

- Proposed index may improve long-range forecasting of Atlantic hurricane activity and could also improve the identification and forecasting of the MJO in the Western Hemisphere.





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A new Madden–Julian oscillation (MJO) index is developed from a combined empirical orthogonal function (EOF) analysis of meridionally averaged 200-hPa velocity potential (VP200), 200-hPa zonal wind (U200), and 850-hPa zonal wind (U850). Like the Wheeler–Hendon Real-time Multivariate MJO (RMM) index, which was developed in the same way except using outgoing longwave radiation (OLR) data instead of VP200, daily data are projected onto the leading pair of EOFs to produce the two-component index. This new index is called the velocity potential MJO (VPM) indices and its properties are quantitatively compared to RMM. Compared to the RMM index, the VPM index detects larger-amplitude MJO-associated signals during boreal summer. This includes a slightly stronger and more coherent modulation of Atlantic tropical cyclones. This result is attributed to the fact that velocity potential preferentially emphasizes the planetary-scale aspects of the divergent circulation, thereby spreading the convectively driven component of the MJO's signal across the entire globe. VP200 thus deemphasizes the convective signal of the MJO over the Indian Ocean warm pool, where the OLR variability associated with the MJO is concentrated, and enhances the signal over the relatively drier longitudes of the equatorial Pacific and Atlantic. This work provides a useful framework for systematic analysis of the strengths and weaknesses of different MJO indices.

Published: December 2013

<http://journals.ametsoc.org/doi/abs/10.1175/MWR-D-12-00327.1>

Linking recruitment synchrony to environmental variability

Fisheries Oceanography

M. M. Stachura, T. E. Essington, N. J. Mantua, A. B. Hollowed, **M. A. Haltuch (NMFS/NWFSC)**, P. D. Spencer, T. A. Branch, and M. Doyle

- Models used in this study could be used to anticipate recruitment trends of less well-studied stocks based on life history traits and knowledge of environmental dynamics.

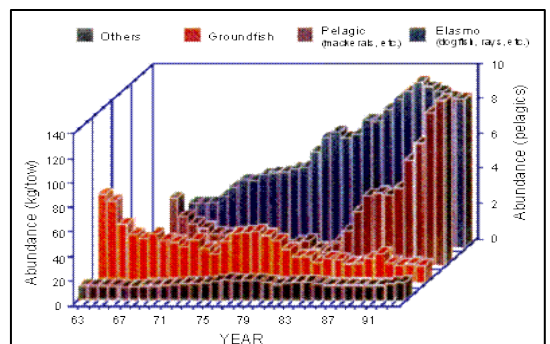
We investigated the hypothesis that synchronous recruitment is due to a shared susceptibility to environmental processes using stock-recruitment residuals for 52 marine fish stocks within three Northeast Pacific large marine ecosystems: the Eastern Bering Sea and Aleutian Islands (BSAI), Gulf of Alaska, and California Current. There was moderate coherence in terms of exceptionally strong and weak year classes and significant distributions of across stock correlation. Based on evidence of synchrony from these analyses, we used Bayesian hierarchical models to relate recruitment to environmental covariates for groups of stocks with similar susceptibility to environmental processes.

Expected Publication Date: February 2014

A test of the use of computer generated visualizations in support of ecosystem-based management

Marine Policy

A. P. Rehr, G. D. Williams, and P. S. Levin (NMFS/NWFSC)





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- Systematic scenario analysis is increasingly being used as an approach to evaluate ecosystem-based management options, often using “storylines” communicated through computer-generated (CG) images or visualizations.
- This work begins to highlight some of the pitfalls, but also the promise, of the use of CG visualization in marine resource management.

To explore potential issues associated with using CG imagery for conveying scenarios of habitat restoration we performed experiments in the Puget Sound, Washington region in which we asked whether respondents could differentiate among images of varying seagrass density and spatial extent, and if the presence of humans in the images affected these assessments and their perceptions of ecosystem health. Respondents were able to grossly determine relative seagrass density in the images, but only about 50% of them were able to determine this perfectly. Most errors occurred when the difference in density was small: approximately 20 shoot m⁻². The ability to correctly distinguish among images was inversely correlated with educational level. The presence or absence of people in the imagery did not influence the ability of respondents to correctly sort images, nor did it affect perceptions of ecosystem “health”. Taken together, the results suggest that such imagery can be useful as the basis for communicating large differences in ecological conditions, but may be less informative as a means to convey marginal changes in ecological structure.

Expected Publication Date: Spring 2014

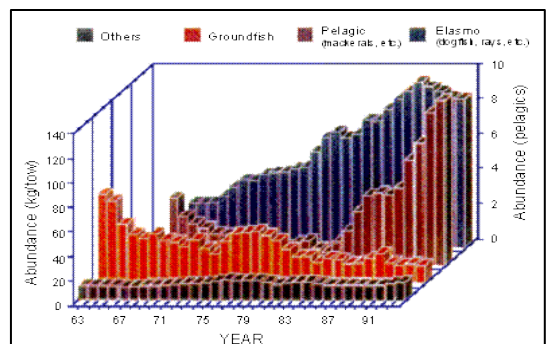
Recommendations for photo-identification methods used with cetaceans

Marine Mammal Science

K. Urian, A. Read, **A. Gorgone (NMFS/SEFSC)**, B. Balmer, R. S. Wells, P. Berggren, **J. Durban (NMFS/SWFSC)**, **T. Eguchi (NMFS/SWFSC)**, W. Rayment, P. Hammond

- This article lists recommendations for best practices in photo-identification surveys of cetaceans to minimize biases in abundance estimates:
 - (1) determine the degree of marking, or level of distinctiveness, and use images of sufficient quality to recognize animals of that level of distinctiveness;
 - (2) ensure that markings are sufficiently distinct to eliminate the potential for “twins” to occur;
 - (3) stratify data sets by distinctiveness and generate a series of abundance estimates to investigate the influence of including animals of varying degrees of markings; and
 - (4) strive to examine and incorporate variability among analysts into capture-recapture estimation.

Capture-recapture methods are frequently employed to estimate abundance of cetaceans using photographic techniques and a variety of statistical models. However, there are many unresolved issues regarding the selection and manipulation of images that can potentially impose bias on resulting





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estimates. To examine the potential impact of these issues, we circulated a test data set of dorsal fin images from bottlenose dolphins to several independent research groups. Photo-identification methods were generally similar, but the selection, scoring and matching of images varied greatly amongst groups. Based on these results we make the following recommendations. Researchers should: (1) determine the degree of marking, or level of distinctiveness, and use images of sufficient quality to recognize animals of that level of distinctiveness; (2) ensure that markings are sufficiently distinct to eliminate the potential for “twins” to occur; (3) stratify data sets by distinctiveness and generate a series of abundance estimates to investigate the influence of including animals of varying degrees of markings; and (4) strive to examine and incorporate variability among analysts into capture-recapture estimation. In this paper we summarize these potential sources of bias and provide recommendations for best practices for using natural markings in a capture-recapture framework.

Accepted: 19 December 2013

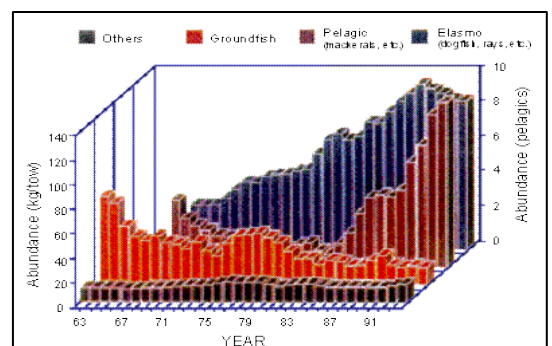
*Methods and accuracy of sexing Sockeye salmon *Oncorhynchus nerka* using ultrasound for captive broodstock management*

North American Journal of Aquaculture

D. A. Frost, W. C. McAuley, B. Kluver, M. Wastel, D. Maynard, and T. A. Flagg (NMFS/NWFSC)

- This article describes the application of ultrasound technology in separating non-maturing fish from maturing fish and verifying sex identification.
- These techniques were successfully employed and are further suggested to help improve captive broodstock management.

Ultrasound has been widely used to noninvasively examine the internal anatomy and reproductive status of many fish species. Since 2003, ultrasonography has been an integral part of broodstock management for ESA-listed endangered Redfish Lake Sockeye salmon *Oncorhynchus nerka*. Initial ultrasound screenings for each year's broodstock were conducted three to four months prior to anticipated maturation, prior to development of external signs of maturation. In keeping with the natural life history of these fish, this permitted the separation of non-maturing fish from maturing fish so the immature fish could maintain feeding and growth. It also permitted maturing seawater-reared fish to be transferred to fresh water for final maturation. A spawning matrix, designed to maintain genetic diversity, required knowledge of the sex of each fish before spawning. To ensure the accuracy of the spawning matrix, a second ultrasound was performed approximately one month prior to spawning to verify sex identification. Over a 9-year period, 2,662 fish were examined. The accuracy of sexing age-3 adult Sockeye salmon ranged from 94.0 to 100%, with an average of 97.7%, while the accuracy of sexing age-4 adult fish ranged from 92.0 to 100%, with an average of 94.4%. The average accuracy was similar for fish examined in seawater or freshwater (98.1% versus 97.3%, respectively). Ultrasound was shown to be an accurate and effective tool for broodstock life history husbandry management.





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FEBRUARY 10, 2014

Expected Publication Date: Spring 2014

*Post-release mortality estimates of loggerhead sea turtles (*Caretta caretta*) caught in pelagic longline fisheries based on satellite data and hooking location*

Aquatic Conservation: Marine and Freshwater Ecosystems

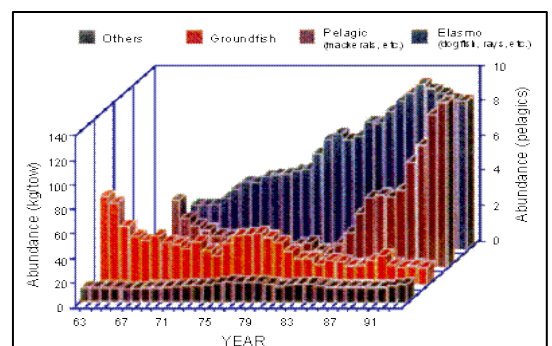
Y. Swimmer (NMFS/PIFSC), C. E. Campora, L. McNaughton, M. Musyl, M. Parga

- Well-integrated and consistent fisheries policies would help improve the probability of survival of loggerhead sea turtles post-release.
- Biochemical correlates of morbidity and mortality (e.g., measuring stress based on disruptions in blood biochemistry) combined with tagging and anatomical hooking descriptions may provide more detailed survival assessments.
- Safe handling of turtles is a critical role in the eventual fate of turtles post-release and should be addressed in policies and training on both U.S. and international levels.

There are few reliable estimates of post-release mortality for sea turtle species because of the many challenges and costs associated with tracking animals released at sea. In this study, the likelihood of sea turtle mortality as a result of interactions with longline fishing gear was estimated based on satellite telemetry data, such as the number of days an animal was successfully tracked, or days at liberty (DAL) and dive depth data, as well as anatomical hooking locations. Pop-up satellite archival tags were deployed on 29 loggerhead sea turtles (*Caretta caretta*) caught by the North Pacific U.S.-based pelagic longline fishery operating from California and Hawaii between 2002 and 2006. Loggerhead turtles were categorized by observers as shallow-hooked (55%) if the animal was entangled in the line or the hook was in the flipper, jaw or mouth and could be removed, or deep-hooked (45%) if the hook was ingested and could not be removed. The vertical movements of turtles were used to infer potential mortalities. Of the 25 tags that reported data, the DAL ranged from 3 to 243 days (mean = 68 days). The DAL was shorted (by nearly 50%) for shallow-hooked (mean = 48 days, range: 3 to 127) compared to deep-hooked turtles (mean = 94 days, range: 5 to 243), but these changes were not statistically significant ($P = 0.0658$). Although aspects of these analyses may be considered speculative, these data provide empirical evidence to indicate that deep-hooking is not linked to shorter DAL. DAL, anatomical hooking location, and gear removal were evaluated with inferences about the extent of injuries and rates of infection to estimate an overall post-release mortality rate of 28% (95% bootstrap CI: 16-52%). This range of estimates is consistent with those used to shape some U.S. fisheries management plans, suggesting that conservation goals are being achieved at the expected level and ideally striking a balance between the interests of industry and those of protected species.

Published Online: 30 September 2013

<http://onlinelibrary.wiley.com/doi/10.1002/aqc.2396/abstract>





NOAA SCIENTIFIC PUBLICATIONS REPORT

FEBRUARY 10, 2014

Life cycle assessment of products from Alaskan salmon byproducts: implications of coproduction, intermittent landings, and storage time

Fisheries Research

J. Cooper, S. Diesburg, A. Babej, M. Noon, E. Kahn, M. Puettmann, **J. Colt (NMFS/NWFSC)**

- The goal of this research is to examine the gate-to-grave life cycle of byproduct (offal) management options for salmon processing in Sitka, Alaska using Life Cycle Assessment.

The bases for comparison are the management of 1 kg of offal and the management of ~33,000 metric tons of offal generated intermittently throughout 2010 in Southeast Alaska for grind and discharge, two types of fresh processing, and stabilized/ensiled offal processing. It is found that the contributions to eutrophication, acidification, and climate change are consistently reduced by assuming product displacements of meal, oil, and gelatin coproducts as compared to grind and discharge. Further, increasing the allowable storage time by stabilizing the byproduct feedstock provides additional benefit by reducing the amount of byproduct ground and discharged.

Published Online: February 2014

<http://www.sciencedirect.com/science/article/pii/S0165783613002932>

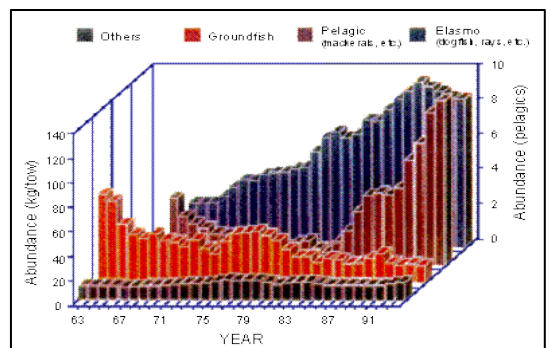
*Isolation and characterization of microsatellites for jumbo squid *Dosidicus gigas* (Ommastrephidae)*

Journal of Genetics

A. M. Millán-Márquez, C. A. Salinas-Zavala, P. Cruz, **D. E. Pearse (NMFS/SWFSC)**

- Current knowledge of the jumbo squid, *Dosidicus gigas*, suggests a strong spatial and temporal variability in population structure, mainly by size and maturity.
- The authors characterized nine polymorphic microsatellites of this species to help constrain the observed variability in population structure in a natural setting.
- The development of genetic markers for use in this species provides a resource for future studies to evaluate stock structure and movement in this important fisheries species.

The jumbo squid, *Dosidicus gigas* (D'Orbigny, 1835), is one of the largest and most abundant members of the family Ommastrephidae. It is an endemic species from the Eastern Pacific, ranging from California, USA (30°N) in the North to central Chile (20°S) in the South (Nesis 1983). Recently, a range extension was recorded as far north as Canada (Field *et al.* 2007; Zeidberg and Robinson 2007; Cosgrove 2005). The highest concentrations of *D. gigas* are found in Peru, Chile and the Gulf of California (Mexico), where it is considered an important fishery resource. Current knowledge of the species suggests a strong spatial and temporal variability in population structure, mainly by size and maturity, both within the Gulf of California (Markaida and Sosa-Nishizaki 2001; Morales-Bojórquez *et al.* 2001) and in other geographical regions (Tafur *et al.* 2001). *Dosidicus gigas* exhibits “offshore-onshore” migrations down and up the shelf slope, and displays different modal size frequency distributions and patterns of maturity index change





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indicating the presence of several cohorts. In addition, the spawning aggregations for *D. gigas* are geographically widespread with different maturation and growth rate and thereby may promote intraspecific genetic variation within stocks (Anderson and Rodhouse 2001). The use of morphometric and/or meristic characters in this group is problematic due to plasticity of body form and growth (Shaw 2002). Three different groups of *D. gigas* have been recognized based on mantle length (ML) at maturity. A small size-at-maturity form comprises animals of 13-14 cm ML and is thought to be limited to equatorial waters. A medium size-at-maturity form, maturing at 24-28 cm ML, occurs across the entire species range, and the northern and southern peripheries of the species range are inhabited by a large size-at-maturity form that matures at 40-55 cm ML or greater (Nigmatullin *et al.* 2001). The aim of this study was to isolate and characterize microsatellite markers in *D. gigas* for later use in population genetic studies. We report a characterization of nine polymorphic microsatellites, although most of them have a deficit of heterozygotes apparently caused by high frequency of null alleles.

Accepted: 12 December 2013

Yolk embolism associated with trauma in vitellogenic sea turtles in Florida (USA): a review of 11 cases Journal of Zoo and Wildlife Medicine

B. A. Stacy (NMFS/OPR), A. Foley, M. M. Garner, N. Mettee

- Case information and postmortem examination findings are presented for 11 adult female sea turtles in reproductive form that died in Florida, USA.
- All had abundant, large vitellogenic follicles, and most were either gravid or had recently nested.
- Identified proximate causes of death included falls or entrapment by obstructions on nesting beaches, burial under collapsed dunes, and other traumatic injuries of different causes.

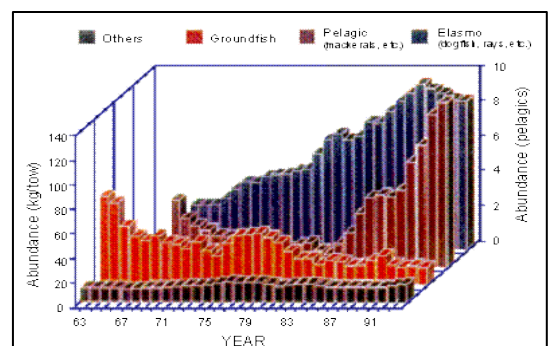
Species included six loggerheads (*Caretta caretta*) and five green turtles (*Chelonia mydas*). Evidence of yolk embolization was found in 10 cases and suspected in an 11th turtle. Ten turtles also had various amounts of free intracoelomic yolk. Although the effects of yolk embolization are uncertain at this time, precedence of pathologic importance in other species suggests that embolism may complicate traumatic injuries, including seemingly minor events.

Accepted: 10 June 2013

Histological changes in traumatized skeletal muscle exposed to seawater: a canine cadaver study Veterinary Pathology

B. A. Stacy (NMFS/OPR), A. M. Costidis, and J. L. Keene

- Authors findings are critical to forensic assessment of traumatic injuries in marine turtles and mammals.
- Allows investigators to obtain key information pertinent to management determinations, including timing of injuries in relation to death and cause of death.





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- Findings presented here are also broadly applicable to many of types of human interaction, e.g. vessel strikes, fisheries interaction, malicious injury.

Wounds were created by incision in skeletal muscle of 2 mixed breed canine cadavers at multiple time points from 0.5 hour to 74.5 hours postmortem, and were exposed to artificial seawater (35 ppt), 0.9% saline (8 ppt), or freshwater for 24 hours prior to fixation for histology. Discoid and segmental disintegration of myofibers deep to the severed edges was observed in injuries inflicted within 6.5 hours of death and exposed to 0.9% saline and seawater, and were not observed in injuries made at later time points or in other treatments. Exposure to artificial seawater had pronounced effects on histomorphology that markedly diminished with increasing postmortem wounding interval. In a third cadaver, these changes were shown to be detectable with confidence following up to 10 days submergence in seawater at 22.2°C despite decomposition. These findings are important for evaluation of skeletal muscle injuries that are exposed to seawater, such as those occurring in marine animals, and may assist in recognizing wounds inflicted either antemortem or within the supravital period.

Expected Publication Date: March 2014

Bootstrapping of sample sizes for length- or age-composition data used in stock assessments

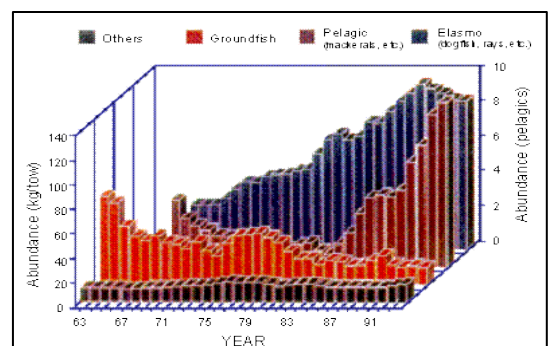
Canadian Journal of Fisheries and Aquatic Sciences

I. J. Stewart and O. S. Hamel (NMFS/NWFSC)

- To improve stock assessment models authors used a new statistical method, verified through simulation, to account for observation error inherent in fishery biological data.
- Authors found that this method improved data weighting in stock assessment and provided a more accurate picture of current stock status and uncertainty.

Integrated stock assessment models derive estimates of management quantities by fitting to indices of abundance and length and age compositions. For composition data, where a multinomial likelihood is often applied, weights are determined by input sample sizes, which can be an important contributor to model results. Authors used a generic bootstrap method, verified through simulation, to calculate year-specific maximum realized sample sizes from the observation error inherent in fishery biological data. Applying this method to length-composition observations for 47 groundfish species collected during a standardized trawl survey, they found maximum realized sample size to be related to both the number of hauls and individual fish sampled from those hauls. Sampling in excess of 20 fish from each haul produced little increase in most cases, with maximum realized sample size ranging from approximately 2-4 per haul sampled. Utilizing these maximum realized sample sizes as input values for stock assessment (analogous to minimum variance estimates), appropriately incorporates interannual variability, and may reduce over-emphasis on composition data. Results from this method can also help determine sampling targets.

Expected Publication Date: Spring 2014





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FEBRUARY 10, 2014

*Spawning phenology and geography of Aleutian Islands and eastern Bering Sea Pacific cod (*Gadus macrocephalus*)*

Deep Sea Research II

S. Neidetcher, T. P. Hurst, L. Ciannelli, E. A. Logerwell (NMFS/AKFSC)

- Spawning of Pacific cod (*Gadus macrocephalus*) in the Bering Sea appears to be more widespread than previously recognized, and the authors describe temporal and spatial patterns of reproductive status over three winter spawning seasons.
- High concentrations of spawning fish were observed north of Unimak Island, in the vicinity of the Pribilof Islands, at the shelf break near Zhemchug Canyon, and adjacent to islands in the central and western Aleutian Islands along the continental shelf
- Fine-scale documentation of spawning areas across the basin will improve understanding of the spatial dynamics of recruitment in this harvested population.

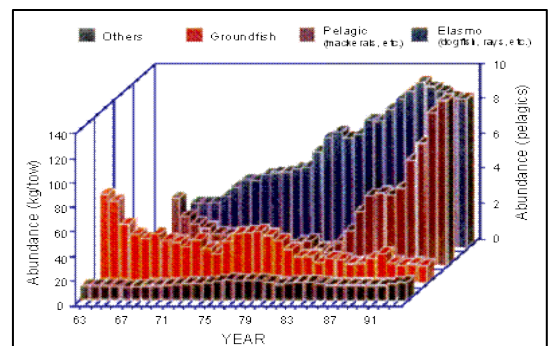
Pacific cod (*Gadus macrocephalus*) is an economically and ecologically important species in the southeastern Bering Sea and Aleutian Islands, yet little is known about the spawning dynamics of Pacific cod in these regions. To address this knowledge gap, we applied a gross anatomical maturity key for Pacific cod to describe temporal and spatial patterns of reproductive status over three winter spawning seasons: 2005, 2006, and 2007. Maturity status of female Pacific cod was assessed by fishery observers during sampling of commercial catches and used to construct maps showing spawning activity in the Bering Sea and Aleutian Islands. Most spawning activity was observed on the Bering Sea shelf and Aleutian Island plateaus between 100 and 200 m depth. Data for those days when a high percentage of spawning stage fish were observed were used to identify areas with concentrations of spawning fish. Spawning concentrations were identified north of Unimak Island, in the vicinity of the Pribilof Islands, at the shelf break near Zhemchug Canyon, and adjacent to islands in the central and western Aleutian Islands along the continental shelf. The spawning season was found to begin in the last days of February or early March and extend through early to mid-April. Variation in spawning time (averaging ~10 days between years) may have been associated with a change from warm (2005) to cold (2007) climate conditions during the study period. Our information on Pacific cod spawning patterns will help inform fishery management decisions, models of spawning and larval dispersal and the spatial structure of the stock.

Expected Publication Date: 31 January 2014

The future of fisheries oceanography lies in the pursuit of multiple hypotheses

ICES Journal of Marine Science

J. Hare (NMFS/NEFSC)





NOAA SCIENTIFIC PUBLICATIONS REPORT

FEBRUARY 10, 2014

- This article provides a review of fisheries oceanography, describes research that is needed to move forward, and stresses the importance of posing and testing hypotheses and using multiple hypotheses.

Fisheries oceanography is largely an applied discipline with a major goal of improving fisheries management and marine conservation. Johan Hjort's critical period hypothesis, and its descendants, remain a dominant theme and focuses on early life stage survival as mediated by prey availability and feeding. Bottom-up forcing, a related hypothesis, focuses on the sequential transfer of energy through the pelagic food web from primary productivity to fishery productivity. Fisheries assessment and management, however, is based on the hypothesis that fishery abundance is determined by time-varying fishing and year-class strength related to spawning stock biomass. Yet another approach assumes that trophic interactions of adults determines abundance. These approaches, their fundamental hypotheses, and underlying processes and mechanisms suggest very different dynamics for fishery populations. Other hypotheses challenge these traditional views: predation of early life stages, parental condition, shifting migration pathways, and physiological limits. Support for these other hypotheses is reviewed and the research needs are described to apply these hypotheses to fisheries assessment and management. Some of these hypotheses were identified by Hjort (e.g., parental condition hypothesis) and others are relative new (e.g., early life stage predation hypothesis). Moving into the future, we should focus on Hjort's approach: multi-hypothesis, integrative, and inter-disciplinary. A range of hypotheses should be pursued with an emphasis on comparing and linking among hypotheses. The results then must be incorporated into current and future fisheries assessments and management decisions to support the long-term sustainability of exploited species and the conservation of threatened and endangered species.

Accepted: 19 January 2014

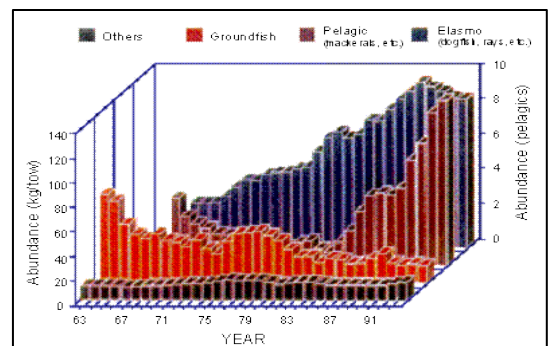
Quantifying and simulating stormwater runoff in watersheds

Hydrological Processes

A. Blair (NOS/NCCOS)

- The Stormwater Runoff Modeling System (SWARM) provides reasonable estimations and simulations of stormwater runoff for small watersheds in the Southeast U.S. coastal plain.
- We have developed calculation and graphic templates for the purpose of simplifying user requirements so that our system will be easily accessible to research scientists, resource managers and decision makers, and others.

We developed the Stormwater Runoff Modeling System (SWARM) based on curve number and unit hydrograph methods of the U.S. Department of Agriculture, Natural Resources Conservation Service. SWARM models single events, targets watersheds fitting easily within hydrologic units with 12-digit codes, and has been calibrated for low-gradient topography of the Southeast coastal plain. We established protocols; made changes related to peak rate factors, travel time formulas, curve numbers, and the initial





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abstraction ratio; and then tested the output with multi-site validation using U.S. Geological Survey measurements of discharge and rainfall. Validation results from both undeveloped and developed watersheds support the robustness of our system in quantifying and simulating runoff: rainfall to runoff differences between measured and simulated volumes ranged from 3 to 11%; r^2 for hydrograph curves ranged from 0.82 to 0.98. SWARM can be a useful tool for scientific research and for coastal resource management and decision making in the Southeast coastal plain specifically and also may be applied to other areas by recalibrating parameters and modifying calculation templates.

Published Online: November 2012

<http://onlinelibrary.wiley.com/doi/10.1002/hyp.9616/abstract>

Modeling PCB-bioaccumulation in the bottlenose dolphin (Tursiops truncatus): estimating a dietary threshold concentration

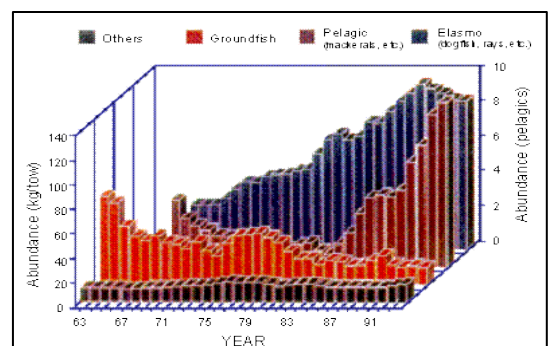
Environmental Science and Technology

B. E. Hickie, M. A. Cadieux, K. N. Riehl, G. D. Bossart, J. J. Alava, and **P. A. Fair (NOS/NCCOS)**

- The model for PCBs in bottlenose dolphins provides a novel approach to estimating the maximum acceptable dietary concentration for PCBs, a central and important factor to protect these apex predators.
- The model also enables effective prediction of concentrations in dolphins from fish contaminant surveys which are easier and less expensive to sample.

An individual based (IB)-model to predict PCB concentrations in the bottlenose dolphin population of Charleston, SC, USA, was developed with the aim to gain a better understanding of the bioaccumulation behavior and health risk of dietary PCBs across the population and their prey. PCB concentrations predicted in male and female bottlenose dolphin were in good agreement with observed tissue concentrations corroborating the reliability of the model performance and its utility in gaining a more complete view of risk. The modeled cumulative distribution of Σ PCB concentrations for the population with a breakdown into juvenile, adult male and female subclasses ranged from 3,600 to 144,400 ng/g lipid with 66 to >80% of the population exceeding the established threshold for adverse health effects of 17,000 ng/g lipid. The model estimated that a dietary PCB concentration not exceeding 5.1 ng/g wet wt. would be required to reach a condition where 95% of the population would have tissue levels below the health effect threshold. The IB model for PCBs in bottlenose dolphins provides a novel approach to estimating the maximum acceptable dietary concentration for PCBs, a central and important factor to protect these apex predators. The model also enables effective prediction of concentrations in dolphins from fish contaminant surveys which are easier and less expensive to sample.

Accepted: 27 September 2013





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FEBRUARY 10, 2014

Genetic stock structure of green turtle (Chelonia mydas) nesting populations across the Pacific islands
Pacific Science

P. H. Dutton (NMFS/SWFSC), M. P. Jensen (NMFS/SWFSC), K. Frutche (NMFS/PIRO), A. Frey (NMFS/SWFSC), E. LaCasella (NMFS/SWFSC), G. H. Balazs (NMFS/PIFSC), J. Cruce, A. Tagarino, R. Farman, and M. Tatarata

- This study identified 7 demographically independent Management Units (rookery stocks) and now provides a baseline dataset to enable meaningful stock identification (Mixed Stock Analysis) of feeding aggregations and fisheries bycatch to be carried out in the Pacific.
- This study advances knowledge that will inform conservation and recovery planning and ESA mandates for NOAA.

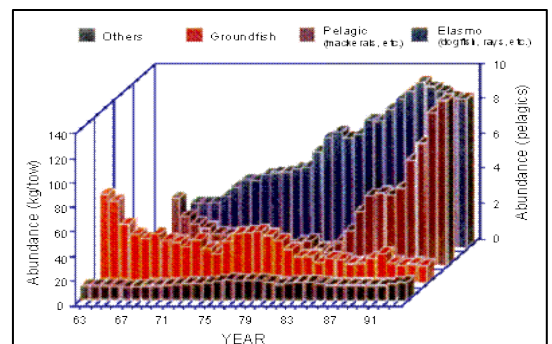
More than two decades have passed since the first studies documenting the genetic population structure of green turtles (*Chelonia mydas*) were published. Since then many more have followed and characterization of the genetic structure of green turtle rookeries now covers most of the global distribution of the species, benefitting conservation of this threatened species worldwide. However, important data gaps still exist across a large part of the Western and Central Pacific Ocean (WCPO). This large area is made up of hundreds of scattered islands and atolls of Micronesia, Melanesia and Polynesia, most of which are remote and difficult to access. In this study, we assess the stock structure of green turtles throughout the WCPO using mitochondrial (mt) DNA from 805 turtles sampled across 25 nesting locations. We examine whether sequencing longer fragments (770 bp) of the control region increases resolution of stock structure and use genetic analysis to evaluate the level of demographic connectivity among island nesting populations in the WCPO. We identified a total of 25 haplotypes characterized by polymorphism within the 770 bp sequences, including 5 new variants of haplotypes that were indistinguishable with shorter 384 bp reads from previous studies. Stock structure analysis indicated that rookeries separated by more than 1000 km were significantly differentiated from each other (F_{ST} values from 0.06 – 0.9, $p < 0.001$) while neighboring rookeries within 500 km showed no genetic differentiation. The results presented in this paper establish that: a) sequencing of longer fragments (770 bp) of the control region does in some cases increase resolution; b) there are at least seven independent stocks in the region.

Expected Publication Date: April 2014

Toxicological effects of the sunscreen UV filter, benzophenone-2, on planula and in vitro cells of the coral, Stylophora pistillata

Ecotoxicology

C. A. Downs, E. Kramarsky-Winter, J. E. Fauth, R. Segal, O. Bronstein, R. Jeger, Y. Lichtenfeld, C. M. Woodley, P. Pennington, F. Al-Horani, A. Kushmaro, Y. Loya (NOS/NCCOS)





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Benzophenone-2 (BP-2) is an additive to personal-care products and commercial solutions that protects against the damaging effects of ultraviolet light. BP-2 is an “emerging contaminant of concern” that is often released as a pollutant through municipal waste-water discharges and landfill leachate, as well as through residential septic fields and unmanaged cesspits. Although BP-2 may be a contaminant on coral reefs, its environmental toxicity to reefs is unknown. This poses a serious management issue, since BP-2 is a known endocrine disruptor as well as a weak genotoxicant. We examined the effects of BP-2 on the larval form (planula) of the coral, *Stylophora pistillata*, as well as its *in vitro* cell toxicity. BP-2 is a photo-toxicant; adverse effects are exacerbated in the light versus in darkness. Whether in darkness or light, BP-2 induced coral planulae to transform from a ciliary planktonic state to a deformed, sessile condition. Planulae exhibited an increasing rate of coral bleaching to increasing concentrations of BP-2. BP-2 is a genotoxicant to corals, exhibiting a strong positive relationship between DNA-AP lesions and increasing BP-2 concentrations. BP-2 exposure in the light induced extensive necrosis in both the epidermis and gastrodermis. In contrast, BP-2 exposure in darkness induced autophagy and autophagic cell death. LC50 of BP-2 in the light for an 8 and 24 hour exposure was 120 ppmillion and 165 ppbillion, respectively. LC50s for BP-2 in darkness for the same time points were 144 ppmillion and 548 ppbillion. Deformities EC20 (24 hours) were 246 pp trillion in the light and 9.6 ppbillion in darkness.

Published: December 2013

<http://link.springer.com/article/10.1007%2Fs10646-013-1161-y>

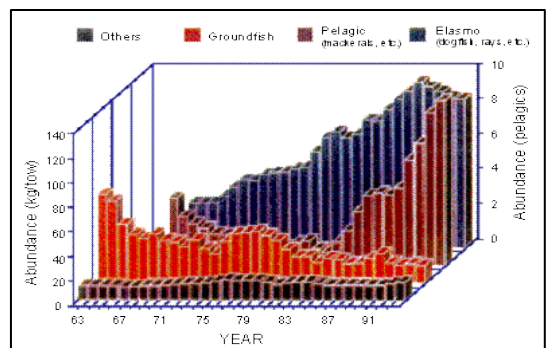
Using beaver dams and other biogenic structures to restore incised stream ecosystems

Bioscience

M. M. Pollock , T. Beechie, C. Jordan, J. Wheaton, N. Bouwes, N. Weber, and C. Volk (NMFS/NWFSC)

- Current models of long-term changes in streams focus on physical characteristics, and most stream restoration efforts concentrate on manipulating physical rather than biological processes.
- Authors suggest that stream recovery is largely dependent on the interaction of biogenic structures, such as beaver dams, with physical processes.
- Results advance our understanding of stream restoration and how streams and riparian areas function as an integrated ecosystem. Authors propose that live vegetation and beaver dams or beaver dam analogues can substantially accelerate the recovery of incised streams.

Biogenic features such as beaver dams, large wood and live vegetation are essential to the maintenance of complex stream ecosystems, yet are largely absent from models explaining how streams evolve over time. Many alluvial streams have recently incised in response to changing climate or land use practices, and because incised streams provide limited ecosystem services there is now interest in restoring them. Current models of long-term changes in streams focus almost exclusively on physical characteristics, and most stream restoration efforts concentrate on manipulating physical rather than biological processes. Authors present an alternative view of incised stream restoration as an ecosystem process, and suggest





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that recovery is largely dependent on the interaction of biogenic structures with physical fluvial processes. In particular, authors propose that live vegetation and beaver dams or beaver dam analogues can substantially accelerate the recovery of incised streams and help to create and maintain complex fluvial ecosystems.

Expected Publication Date: Spring 2014

Integration of passive acoustic monitoring data into OBIS-SEAMAP, a global biogeographic database, to advance spatially-explicit ecological assessments

Ecological Informatics

E. Fujioka, **M. S. Soldevilla (NMFS/SEFSC)**, A. J. Read, and P. N. Halpin

- Authors expanded OBIS-SEAMAP, a global biogeographic database specializing in marine mammals, seabirds and sea turtles, to store and share data collected from passive acoustic methods.
- Mapping and visualization tools have been improved to enhance temporal representation of animal occurrence and effort data, uniquely render PAM data, and visualize occurrence of multiple call types from a single species.
- This integrated database facilitates in-depth ecological assessments that form the foundation for spatially-explicit conservation efforts.

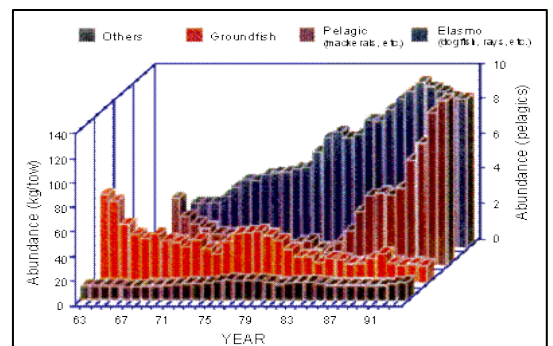
Authors successfully developed an extension of the OBIS-SEAMAP database, a global biogeographic database specializing in marine mammals, seabirds and sea turtles, to integrate passive acoustic monitoring (PAM) data with other commonly collected data types (i.e. line-transect visual sightings, animal telemetry, and photo-identification). As part of this effort, they made significant improvements in mapping and visualization tools for PAM data, including spatially and temporally interactive summary statistics, diel plots, temporal effort representation, and the unique rendering of PAM data to distinguish them from other data types. In this paper, they summarize technical challenges they overcame, report the methodologies and implementation of the integration, and conduct case studies using visual sightings and PAM data from bowhead whales and Risso's dolphins to demonstrate how the integrated database facilitates in-depth ecological assessments that form the foundation for spatially-explicit conservation efforts.

Published Online: December 16, 2013

<http://www.sciencedirect.com/science/article/pii/S1574954113001258>

Endangered Species Act listing; three case studies of data deficiencies and consequences of ESA 'threatened' listing on research output

Current Opinion in Environmental Sustainability





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M. Weijerman (JIMAR), C. Birkeland, G. A. Piniak, **M. W. Miller (NMFS/SEFSC)**, **C. M. Eakin (NOAA Coral Reef Watch)**, **P. McElhany (NMFS/NWFSC)**, **M. J. Dunlap (JIMAR)**, M. Patterson, **R. E. Brainard (NMFS/PIFSC)**

- ESA listing may increase applications for research permits because of funding increases, regulatory requirements for research, desire of scientists to work on species with high public interest or other reasons; however, the permitting of research on listed species may become administratively burdensome.
- Different ESA assessments may reach different conclusions because they are conducted by different groups of people.

Determining whether a species warrants listing as threatened or endangered under the U.S. Endangered Species Act depends on the government's assessment of the species' extinction risk, usually in response to a petition. Deciding whether data are sufficient to make a listing determination is a challenging part of the process. We examined three case studies involving corals. A petition for deep-sea corals was rejected for full status review of the species, based on insufficient information on population trends and threats. Information on threats for 82 tropical corals was sufficient to propose listing of 66 species. Significant population declines and identified threats resulted in listing two Atlantic *Acropora* corals as "Threatened". There was no decrease in journal publication rate on the *Acropora* species after that listing, and no decrease in research permit applications in marine protected areas. However, the effects of listings on research that might help to sustain or recover species remain largely unknown.

Published: DOI: 10.1016/j.cosust.2013.11.026

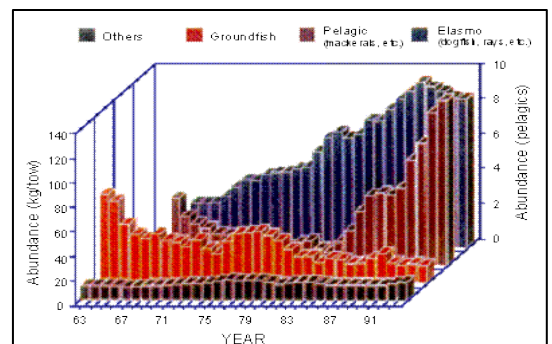
A mixing model to include uncertainty in sediment fingerprinting

Geoderma

K. Nosrati, G. Govers, B. X. Semmens, and **E. J. Ward (NMFS/NWFSC)**

- This is one of the first examples of applying mixing models to large environmental datasets. There are implications for stable isotope work, environmental fingerprinting, and forensic case studies for fish.

Information on sediment sources is required for effective sediment control strategies, to understand nutrient and pollutant transport, and for developing soil erosion models. Uncertainty associated with sediment fingerprinting mixing models is often substantial, but this uncertainty has not yet been fully incorporated in these models. The main objectives of this study are to apply geochemical fingerprints to determine relative contributions of sediment sources and to develop a Bayesian-mixing model that estimates probability distributions of source contributions to a mixture associated with multiple sources for assessing the uncertainty estimation in sediment fingerprinting in the Hiv catchment, Iran. In this analysis, 28 tracers were measured in 42 different sampling sites from three sediment sources (rangeland, orchard and stream bank) and 12 sediment samples from reservoir check dams. Discriminant





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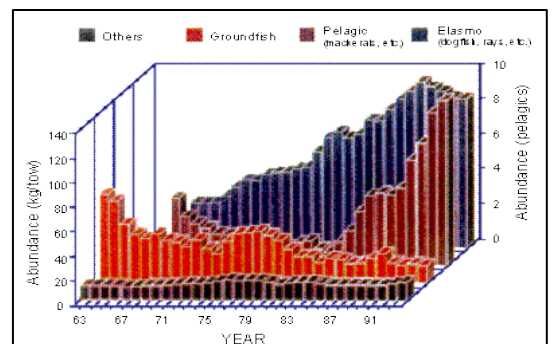
analysis provided an important data reduction as it identified four tracers, i.e. B, C, Sr and Tl, that afforded more than 97% correct assignments in discriminating between the sediment sources in the study area. Using a stable isotope mixing model, the median contribution from rangeland, orchard and stream bank sources was 20.8%, 11.2% and 68%, respectively. Sediment source fingerprinting was used to explore the uncertainty in the contributions of sediment from the three sources. Uncertainty is considerable, as the range of probable values was wide: 2-24% for rangeland, 1-26% for orchards and 66-83 % for stream banks respectively. While these results can be useful as a scientific basis of sediment management and selecting the soil erosion control methods for decision makers of natural resources they also show that it may not always be possible to identify sediment sources with great precision. Consequently, uncertainty needs to be accounted for when evaluating different management options. Expected Publication Date: Spring 2014

Combining demographic and genetic factors to assess population vulnerability in stream species Ecological Applications

E.L. Landguth, C. C. Muhlfeld, **R. S. Waples (NMFS/NWFSC)**, L. Jones, D. Whited, W.H. Lowe, J. Lucotch, H. Neville, and G. Luikart

- This demogenetic simulation framework, which is illustrated in a web-based interactive mapping prototype (<http://ptolemy.dbs.umt.edu/pvm/>), should be useful for evaluating population vulnerability in a wide variety of dendritic and fragmented riverscapes, helping to guide conservation and management efforts for freshwater species.
- Results will help predict responses of aquatic species to climate change.

Accelerating climate change and other cumulative stressors create an urgent need to understand the influence of environmental variation and landscape features on the connectivity and vulnerability of freshwater species. Here, we introduce a novel modeling framework for aquatic systems that integrates spatially-explicit, individual-based, demographic and genetic (demogenetic) assessments with environmental variables. To show its potential utility, we simulated a hypothetical network of 19 migratory riverine populations (e.g., salmonids) using a riverscape connectivity and demogenetic model (CDFISH). We assessed how stream resistance to movement -- a function of water temperature, fluvial distance, and physical barriers -- might influence demogenetic connectivity and hence population vulnerability. We present demographic metrics (abundance, immigration, and change in abundance) and also genetic metrics (diversity, differentiation, and change in differentiation), and combine them into a single vulnerability index for identifying populations at risk of extirpation. We considered four realistic scenarios that illustrate the relative sensitivity of these metrics for early detection of reduced connectivity: (1) maximum resistance due to high water temperatures throughout the network, (2) minimum resistance due to low water temperatures throughout the network, (3) increased resistance at a tributary junction caused by a partial barrier, and (4) complete isolation of a tributary, leaving resident





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individuals only. We then apply this demogenetic framework using empirical data for a bull trout metapopulation in the upper Flathead River system, Canada and USA, to assess how current and predicted future stream warming may influence population vulnerability. Results suggest that warmer water temperatures and associated barriers to movement (e.g., low flows, de-watering) are predicted to fragment suitable habitat for migratory salmonids, resulting in the loss of genetic diversity and reduced sizes in certain vulnerable population.

Accepted: December 17, 2013

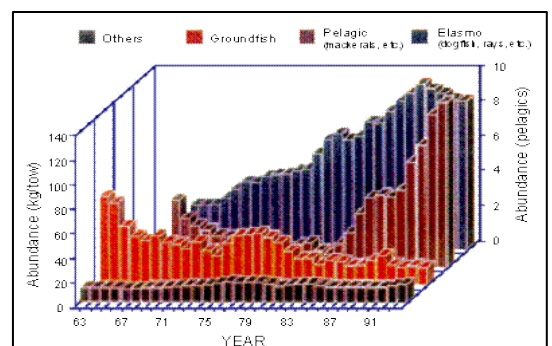
Impacts of Coastal Development on the Ecology of Tidal Creek Ecosystems of the U.S. Southeast Including Consequences to Humans

Estuaries and Coasts

D. Sanger, **A. Blair**, G. DiDonato, T. Washburn, S. Jones, G. Riekerk, **E. Wirth**, J. Stewart, D. White, L. Vandiver, and A. F. Holland (**NOS/NCCOS/Center for Human Health Risk (CHHR)**)

- We expanded a conceptual model to identify and describe the source – receptor links between coastal development and anticipated impacts on tidal creek ecosystems.
- Our conceptual model provides managers or land use planners with a valuable tool to understand the impacts of developments on the environmental quality and potential human consequences in nearby tidal creeks and thereby inform the decision-making process.

Upland areas of southeastern United States tidal creek watersheds are popular locations for development, and they form part of the estuarine ecosystem characterized by high economic and ecological value. The primary objective of this work was to define the relationships between coastal development, with its concomitant land use changes and associated increases in nonpoint source pollution loading, and the ecological condition of tidal creek ecosystems including related consequences to human populations and coastal communities. Nineteen tidal creek systems, located along the southeastern US coast from southern North Carolina to southern Georgia, were sampled in the summer, 2005 and 2006. Within each system, creeks were divided into two primary segments based upon tidal zoning — intertidal (i.e., shallow, narrow headwater sections) and subtidal (i.e., deeper and wider sections) — and then watersheds were delineated for each segment. Relationships between coastal development, concomitant land use changes, nonpoint source pollution loading, the ecological condition of tidal creek ecosystems, and the potential impacts to human populations and coastal communities were evaluated. In particular, relationships were identified between the amount of impervious cover (indicator of coastal development) and a range of exposure and response measures including increased chemical contamination of the sediments, increased pathogens in the water, increased nitrate/nitrite levels, increased salinity range, decreased biological productivity of the macrobenthos, alterations to the food web, increased flooding potential, and increased human risk of exposure to pathogens and harmful chemicals. The integrity of tidal creeks, particularly the headwaters or intertidally dominated sections,





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was impaired by increases in nonpoint source pollution associated with sprawling urbanization (i.e., increases in impervious cover). This finding suggests that these habitats are valuable early warning sentinels of ensuing ecological impacts and potential public health and flooding risk from sprawling coastal development. The results also validate the use of a conceptual model with impervious cover thresholds for tidal creek systems in the southeast region.

Published Online: May 3, 2013

<http://link.springer.com/article/10.1007%2Fs12237-013-9635-y>

OTHER REPORTS, BOOK CHAPTERS, AND INTERNAL PUBLICATIONS

Ocean Acidification: The Other Climate Change Issue

American Scientist Magazine

A. Johnson, N. White (NOS/NCCOS)

- Authors review of the current literature available to bring attention to the potential harm of increased acidity in ocean ecosystems.
- Authors provide further emphasis on the goals of the NOAA Ocean Acidification program.

The ocean plays a significant role in sequestering carbon from the atmosphere, but this carbon then contributes to a steep rise in the acidity of the seawater. The effects of ocean acidification fall not just on certain species or particular regions, but throughout the food webs of the globe. Although planning and resource management hold some promise for addressing the threat of acidification, the unpredictable time scale and the variable nature of its effects remain stubborn challenges.

Published: February 2014

<http://www.americanscientist.org/issues/feature/2014/1/ocean-acidification-the-other-climate-change-issue>

